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SUPERFUND TECHNICAL ASSESSMENT & RESPONSE TEAM V  
EPA CONTRACT NO.: 68HE0319D0004

May 28, 2021

Mr. Peter Lisichenko, On-Scene Coordinator  
U.S. Environmental Protection Agency, Region II  
Superfund and Emergency Management Division  
2890 Woodbridge Avenue  
Edison, NJ 08837

**EPA CONTRACT No: 68HE0319D0004**

**TD No.: TO-0036-0021**

**DC No.: STARTV-02-D-0148**

**SUBJECT: SITE-SPECIFIC UFP QUALITY ASSURANCE PROJECT PLAN  
HOLY TRINITY CEMETERY SITE, AREA 6 & 7  
LEWISTON, NIAGARA COUNTY, NEW YORK**

Dear Mr. Lisichenko,

Enclosed please find the Site-Specific Uniform Federal Policy (UFP) Quality Assurance Project Plan (QAPP) for the Removal Action (RV2) to be conducted by the U.S. Environmental Protection Agency, Region II (EPA) with the support of Weston Solutions, Inc., Superfund Technical Assessment & Response Team V (START V) at the Holy Trinity Cemetery Site, Area 6 & 7 (the Site) in Lewiston, Niagara County, New York. This plan covers the ground radiological survey and soil sampling activities to be conducted at the Site beginning on June 2, 2021.

If you have any questions or comments, please do not hesitate to contact me at (908) 565-2985.

Sincerely,

WESTON SOLUTIONS, INC.

Tom O'Donnell  
START V Site Project Manager

Enclosure:  
cc: TD File: TO-0036-0021



# **SITE-SPECIFIC UFP QUALITY ASSURANCE PROJECT PLAN**

## **HOLY TRINITY CEMETERY SITE, AREA 6 & 7**

**Lewiston, Niagara County, New York**

Site Code: A23M

CERCLIS Code: NYN000206698

Prepared by:

Superfund Technical Assessment & Response Team V  
Weston Solutions, Inc.  
Federal East Division  
Edison, New Jersey 08837

Prepared for:

U.S. Environmental Protection Agency, Region II  
Superfund and Emergency Management Division  
2890 Woodbridge Avenue  
Edison, New Jersey 08837

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May 2021

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## **LIST OF ATTACHMENTS**

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**Attachment B** – ERT/SERAS SOP # 2001 – *General Field Sampling Guidelines*  
ERT/SERAS SOP # 2006 – *Sample Equipment Decontamination*  
ERT/SERAS SOP # 2012 – *Soil Sampling*

## LIST OF ACRONYMS

ADR	Automated Data Review
ANSETS	Analytical Services Tracking System
AOC	Acknowledgment of Completion
ASTM	American Society for Testing and Materials
CEO	Chief Executive Officer
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CLP	Contract Laboratory Program
CFM	Contract Financial Manager
CO	Contract Officer
COI	Conflict of Interest
COO	Chief Operations Officer
CRDL	Contract Required Detection Limit
CRTL	Core Response Team Leader
CRQL	Contract Required Quantitation Limit
CQLOSS	Corporate Quality Leadership and Operations Support Services
CWA	Clean Water Act
DCN	Document Control Number
DI	Deionized Water
DPO	Deputy Project Officer
DQI	Data Quality Indicator
DQO	Data Quality Objective
EM	Equipment Manager
EDD	Electronic Data deliverable
ENVL	Environmental Unit Leader
EPA	Environmental Protection Agency
ERT	Environmental Response Team
FASTAC	Field and Analytical Services Teaming Advisory Committee
GC/ECD	Gas Chromatography/Electron Capture Detector
GC/MS	Gas Chromatography/Mass Spectrometry
HASP	Health and Safety Plan
HRS	Hazard Ranking System
HSO	Health and Safety Officer
ITM	Information Technology Manager
LSASD	Laboratory Services and Applied Science Division
LEL	Lower Explosive Limit
MSA	Mine Safety Appliances
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NELAC	National Environmental Laboratory Accreditation Conference
NELAP	National Environmental Laboratory Accreditation Program
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
OSC	On-Scene Coordinator
OSHA	Occupational Safety and Health Administration

### **LIST OF ACRONYMS (Concluded)**

OSWER	Office of Solid Waste and Emergency Response
PARCCS	Precision, Accuracy, Representativeness, Completeness, Comparability, Sensitivity
PAH	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PE	Post Excavation
PIO	Public Information Officer
PM	Program Manager
PO	Project Officer
PRP	Potentially Responsible Party
PT	Proficiency Testing
QA	Quality Assurance
QAL	Quality Assurance Leader
QAPP	Quality Assurance Project Plan
QMP	Quality Management Plan
QA/QC	Quality Assurance/Quality Control
QC	Quality Control
RC	Readiness Coordinator
RCRA	Resource Conservation and Recovery Act
RPD	Relative Percent Difference
RSCC	Regional Sample Control Coordinator
RST	Removal Support Team
SARA	Superfund Amendments and Reauthorization Act
SEDD	Staged Electronic Data Deliverable
SOP	Standard Operating Practice
SOW	Statement of Work
SPM	Site Project Manager
START	Superfund Technical Assessment & Response Team
STR	Sampling Trip Report
TAL	Target Analyte List
TCL	Total Compound List
TD	Technical Direction
TDL	Technical Direction Letter
TO	Task Order
TQM	Total Quality Management
TSCA	Toxic Substances Control Act
UFP	Uniform Federal Policy
VOA	Volatile Organic Analysis

**TABLE 1 — Crosswalk**

Optimized UFP-QAPP Worksheets		2106-G-05 QAPP Guidance Section	
A. Project Management and Objectives			
1 & 2	Title and Approval Page	2.2.1	Title, Version, and Approval/Sign-Off
3 & 5	Project Organization and QAPP Distribution	2.2.3	Distribution List
		2.2.4	Project Organization and Schedule
4, 7, & 8	Personnel Qualifications and Sign-Off Sheet	2.2.1	Title, Version, and Approval/Sign-Off
		2.2.7	Special Training Requirements and Certifications
6	Communication Pathways	2.2.4	Project Organization and Schedule
9	Project Planning Session Summary	2.2.5	Project Background, Overview, and Intended Use of Data
10	Conceptual Site Model (CSM)	2.2.5	Project Background, Overview, and Intended Use of Data
11	Project/Data Quality Objectives	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
12	Measurement Performance Criteria	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
13	Secondary Data Uses and Limitations	Chapter 3	QAPP ELEMENTS FOR EVALUATING EXISTING DATA
14 & 16	Project Tasks & Schedule	2.2.4	Project Organization and Schedule
15	Project Action Limits and Laboratory-Specific Detection/Quantitation Limits	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
B. Measurement/Data Acquisition			
17	Sampling Design and Rationale	2.3.1	Sample Collection Procedure, Experimental Design, and Sampling Tasks
18	Sampling Locations and Methods	2.3.1	Sample Collection Procedure, Experimental Design, and Sampling Tasks
		2.3.2	Sampling Procedures and Requirements
19 & 30	Sample Containers, Preservation, and Hold Times	2.3.2	Sampling Procedures and Requirements
20	Field Quality Control (QC) Sample Summary	2.3.5	QC Requirements
21	Field Standard Operating Procedures (SOPs)	2.3.2	Sampling Procedures and Requirements

**TABLE 1 — Crosswalk (Concluded)**

Optimized UFP-QAPP Worksheets		2106-G-05 QAPP Guidance Section	
B. Measurement/Data Acquisition			
22	Field Equipment Calibration, Maintenance, Testing, and Inspection	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
23	Analytical SOPs	2.3.4	Analytical Methods Requirements and Task Description
24	Analytical Instrument Calibration	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
26 & 27	Sample Handling, Custody, and Disposal	2.3.3	Sample Handling, Custody Procedures, and Documentation
28	Analytical QC and Corrective Action	2.3.5	QC Requirements
29	Project Documents and Records	2.2.8	Document and Records Requirements
C. Assessment/Oversight			
31, 32, & 33	Assessments and Corrective Action	2.4	ASSESSMENTS AND DATA REVIEW (CHECK)
		2.5.5	Reports to Management
D. Data Review			
34	Data Verification and Validation Inputs	2.5.1	Data Verification and Validation Targets and Methods
35	Data Verification Procedures	2.5.1	Data Verification and Validation Targets and Methods
36	Data Validation Procedures	2.5.1	Data Verification and Validation Targets and Methods
37	Data Usability Assessment	2.5.2	Quantitative and Qualitative Evaluations of Usability
		2.5.3	Potential Limitations on Data Interpretation
		2.5.4	Reconciliation with Project Requirements

## QAPP Worksheet #1 & 2: Title and Approval Page


### 1. Project Identifying Information

- a) **Site Name/Project Name:** Holy Trinity Cemetery Site  
b) **Site Location/No.:** Lewiston, Niagara County, New York / NYN000206698  
c) **Contract/Work Assignment No.:** 68HE0319D0004 / TDD#: 0036-0021

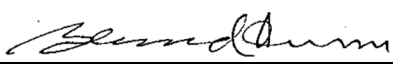
### 2. Lead Organization

Weston Solutions, Inc.  
1090 King Georges Post Road, Suite 201  
Edison, New Jersey 08837

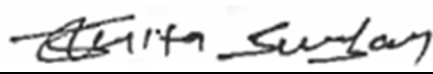
#### Lead Organization's Site Project Manager:

Thomas O' Donnell		05/28/2021
Printed Name/Title	Signature	Date

#### Lead Organization's Technical Review:

Bernard Nwosu		05/28/2021
Printed Name/Title	Signature	Date

#### Lead Organization's QA/QC Chemist:

Smita Sumbaly		05/28/2021
Printed Name/Title	Signature	Date

#### EPA Region II On-Scene Coordinator:

Peter Lisichenko		
Printed Name/Title	Signature	Date

#### EPA Region II Quality Assurance Officer:

Printed Name/Title	Signature	Date

Document Control Number: STARTV-02-D-0148

**QAPP Worksheet #1& 2: Title and Approval Page (Concluded)**

**3. List Plans and reports from previous investigation relevant to this project.**

08/06/2015, Site-Specific QAPP, Holy Trinity Cemetery Radiological Assessment, (RST3-02-D-0037)

04/12/2016, Site-Specific QAPP- Radiological Survey, Holy Trinity Cemetery Radiological Assessment, (RST3-02-D-0250)

08/17/2016, Site-Specific UFP Quality Assurance Project Plan, Holy Trinity Cemetery Assessment, (RST3-03-D-0230)

05/02/2017, Site-Specific UFP QAPP, Revision 1, Holy Trinity Cemetery Assessment, (RST3-03-D-0258)

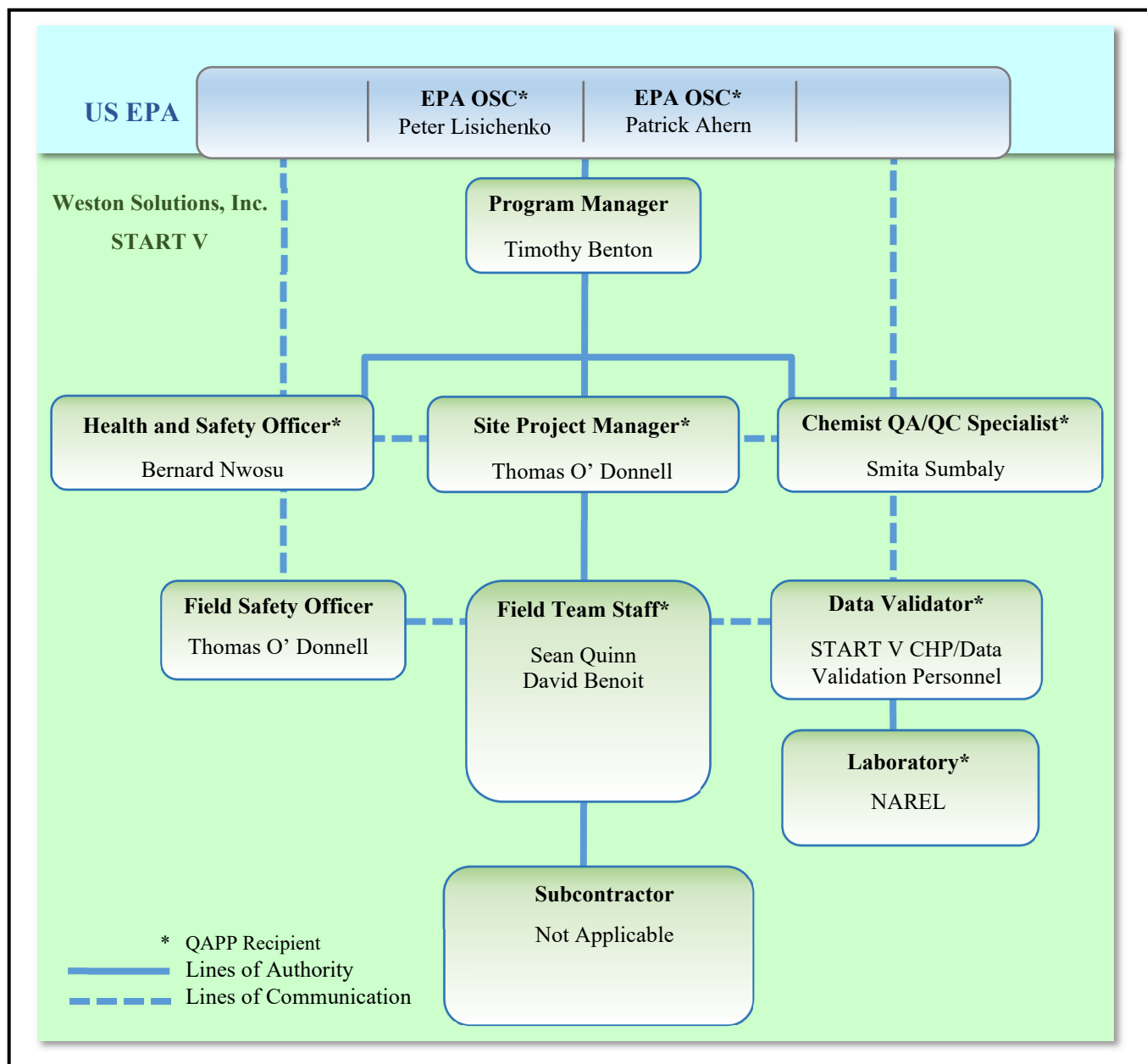
11/05/2020 Site-Specific UFP QAPP, Holy Trinity Cemetery Assessment, (STARTV-02-D-0059)

04/24/2021 Site-Specific UFP QAPP, Holy Trinity Cemetery Assessment, (STARTV-02-D-0127)

**Exclusions:**

None.

### QAPP Worksheet #3 & 5: Project Organizational and QAPP Distribution



#### Acronyms:

EPA – U.S. Environmental Protection Agency  
QA/QC – Quality Assurance/Quality Control  
START V – Superfund Technical Assistance & Response Team V  
OSC – On-Scene Coordinator  
NAREL – National Analytical Radiation Environmental Laboratory  
CHP – Certified Health Physicist

### QAPP Worksheet #3 & 5: Project Organizational and QAPP Distribution (Concluded)

QAPP Recipient	Title	Organization	Telephone Number	Fax Number	E-mail Address	Document Control Number
Peter Lisichenko	OSC	EPA, Region II	(347) 276-6251	NA	<a href="mailto:lisichenko.peter@epa.gov">lisichenko.peter@epa.gov</a>	STARTV-02-D-0148
Patrick Ahern	OSC	EPA, Region II	(347) 931-2520	NA	<a href="mailto:Ahern.Patrick@epa.gov">Ahern.Patrick@epa.gov</a>	STARTV-02-D-0148
Bernard Nwosu	SPM/HSO	Weston Solutions, Inc., START V	(732) 585-4413	NA	<a href="mailto:Ben.Nwosu@WestonSolutions.com">Ben.Nwosu@WestonSolutions.com</a>	STARTV-02-D-0148
Thomas O'Donnell	SPM	Weston Solutions, Inc., START V	(908) 565-2985	NA	<a href="mailto:Thomas.ODonnell@WestonSolutions.com">Thomas.ODonnell@WestonSolutions.com</a>	STARTV-02-D-0148
David Benoit	Field Personnel	Weston Solutions, Inc., START V	(732) 585-4449	NA	<a href="mailto:David.Benoit@WestonSolutions.com">David.Benoit@WestonSolutions.com</a>	STARTV-02-D-0148
Smita Sumbaly	QAO	Weston Solutions, Inc., START V	(732) 585-4410	NA	<a href="mailto:S.Sumbaly@WestonSolutions.com">S.Sumbaly@WestonSolutions.com</a>	STARTV-02-D-0148
Site TD File	START V Site TD File	Weston Solutions, Inc., START V	Not Applicable	NA	Not Applicable	STARTV-02-D-0148

EPA – U.S. Environmental Protection Agency  
 OSC – On-Scene Coordinator  
 SPM – Site Project Manager  
 START V – Superfund Technical Assistance & Response Team V  
 QAO – Quality Assurance Officer  
 HSO – Health & Safety Officer  
 NA – Not Applicable  
 TBD – To Be Determined

### QAPP Worksheet #4, 7 & 8: Personnel Qualification and Sign-off Sheet





Project Function	Specialized Training By Title or Description of Course	Training Provider	Training Date	Personnel / Groups Receiving Training	Personnel Titles / Organizational Affiliation	Location of Training Records / Certificates <sup>1</sup>	Date of Training
<b>[Specify location of training records and certificates for samplers]</b>							
QAPP Training	This training is presented to all START V personnel to introduce the provisions, requirements, and responsibilities detailed in the UFP QAPP. The training presents the relationship between the site-specific QAPPs, SOPs, work plans, and the Generic QAPP. QAPP refresher training will be presented to all employees following a major QAPP revision.	Weston Solutions, Inc., (In House Training)	As needed	All START V field personnel upon initial employment and as refresher training	Weston Solutions, Inc.	Within Division	April 2021
Health & Safety Training	Health and safety training will be provided to ensure compliance with Occupational Safety and Health Administration (OSHA) as established in 29 CFR 1910.120.	Weston Solutions, Inc., (In House Training)	Yearly at a minimum	All Employees upon initial employment and as refresher training every year	Weston Solutions, Inc.	Within Division	March 2021
Others	Scribe, ICS 100 and 200, and Air Monitoring Equipment Trainings provided to all employees	EPA ERT (In-House Training) FEMA (On-line Training) Weston Solutions, Inc., (In House training)	Upon initial employment and as needed				March 2021
	Dangerous Goods Shipping	Weston Solutions, Inc., (In House Training)	Every 3 years				March 2021

All team members are trained in the concepts and procedures in recognizing opportunities for continual improvement, and the approaches required to improve procedures while maintaining conformance with legal, technical, and contractual obligations.

<sup>1</sup>All members, including subcontractors, certifications are in possession of Health & Safety Officer.

### QAPP Worksheet #4, 7 & 8: Personnel Qualification and Sign-off Sheet

#### Organization: Weston Solutions, Inc., START V

Name	Project Title/Role	Education and Experience Qualifications	Specialized Training/Certifications	Organizational Affiliation	Signature	Date
Thomas O'Donnell	SPM/HSO, START V	2+ years*	Implementing and executing the technical, QA and health and safety during sampling event, sample collection and sample management.	Weston Solutions, Inc.		5/28/2021
David Benoit	Field Personnel, START V	1 year*	Sample Collection/Sample Management	Weston Solutions, Inc.		5/28/2021
Bernard Nwosu	SPM/HSO, START V	25+ years*	Health and Safety Officer	Weston Solutions, Inc.		5/28/2021
Smita Sumbaly	QAO, START V	30 years*	Chemist QA/QC Specialist	Weston Solutions, Inc.		5/28/2021

\*All START V members and subcontractor's resumes are in possession of START V Program Manager, EPA Project Officer, and Contracting officers.

SPM – Site Project Manager

START V – Superfund Technical Assistance & Response Team V

QAO – Quality Assurance Officer

HSO – Health & Safety Officer

TBD – To Be Determined

#### Organization: EPA Region II

Name	Project Title/Role	Education and Experience Qualifications	Specialized Training/Certifications	Organizational Affiliation	Signature	Date
Peter Lisichenko	EPA OSC	NA	All project coordination, direction and decision making.	EPA, Region II		
Patrick Ahern	EPA OSC	NA	All project coordination, direction and decision making.	EPA, Region II		

EPA – U.S. Environmental Protection Agency

OSC – On-Scene Coordinator

### QAPP Worksheet #6: Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure
Point of contact with EPA OSC	SPM, Weston Solutions, Inc., START V	Thomas O'Donnell	(908) 565-2985	All technical, QA and decision-making matters in regard to the project (verbal, written or electronic)
Adjustments to QAPP	SPM, Weston Solutions, Inc., START V	Thomas O'Donnell	(908) 565-2985	QAPP approval dialogue
Health and Safety On-Site Meeting	HSO, Weston Solutions, Inc., START V	Thomas O'Donnell	(908) 565-2985	Explain Site hazards, personnel protective equipment, hospital location, etc.
Lab Data Quality Issues (including sample receipt variances and laboratory quality control variances)	Project Manager NAREL Project Manager	Tonya Hudson	(334) 270-3433	Laboratory PMs will report any issues with project samples to the WESTON Chemist QA/QC Specialist within 1 business day of notification. The WESTON Chemist QA/QC Specialist will contact the field sampler if necessary to resolve sample receiving discrepancies.
Data verification and data validation issues	WESTON Data Validator WESTON CHP	Smita Sumbaly TBD	(732) 585-4410 TBD	The WESTON Data Validators/CHP will review the data verification and validation.
Analytical Corrective Actions	WESTON Chemist QA/QC Specialist Project Manager NAREL Project Manager	Smita Sumbaly  Tonya Hudson	(732) 585-4410  (334) 270-3433	If laboratory corrective actions are necessary, the WESTON Chemist QA/QC Specialist will communicate with the NAREL laboratory PM.
Data Tracking and Management, Release of Analytical Data	WESTON Chemist QA/QC Specialist WESTON SPM, WESTON, Operations Manager	Smita Sumbaly  Thomas O'Donnell Bernard Nwosu	(732) 585-4410  (908) 565-2985 (908) 565-2980	The need for corrective actions will be determined by the SPM upon review of the data. No analytical data will be released prior to validation and all releases must be approved by the Chemist QA/QC Specialist, SPM and EPA OSC/TM.

OSC: On-Scene Coordinator  
SPM: Site Project Manager  
HSO: Health and Safety Officer  
QA/QC: Quality Assurance/Quality Control  
START V: Superfund Technical Assistance & Response Team V  
NAREL: National Analytical Radiation Environmental Laboratory  
CHP: Certified Health Physicist

## QAPP Worksheet #9: Project Planning Session Summary

<b>Date of Planning Session:</b> 05/24/2021				
<b>Location:</b> Teams Meeting				
<b>Purpose:</b> Scoping meeting for UFP-QAPP for EPA Region II START V				
Name	Title	Affiliation	E-mail Address	Phone No.
Peter Lisichenko	EPA OSC	EPA	<a href="mailto:lisichenko.peter@epa.gov">lisichenko.peter@epa.gov</a>	(603)-512-4350
Patrick Ahern	EPA OSC	EPA, Region II	<a href="mailto:Ahern.Patrick@epa.gov">Ahern.Patrick@epa.gov</a>	(347) 931-2520
Bernard Nwosu	START V HSO	Weston Solutions, Inc., START V	<a href="mailto:Ben.Nwosu@WestonSolutions.com">Ben.Nwosu@WestonSolutions.com</a>	(732) 585-4413
Tim Benton	START V Program Manager	Weston Solutions, Inc., START V	<a href="mailto:Tim.Benton@WestonSolutions.com">Tim.Benton@WestonSolutions.com</a>	(732) 585-4425
Thomas O'Donnell	START V SPM	Weston Solutions, Inc., START V	<a href="mailto:Thomas.ODonnell@WestonSolutions.com">Thomas.ODonnell@WestonSolutions.com</a>	(908) 565-2985
David Benoit	START V	Weston Solutions, Inc., START V	<a href="mailto:David.Benoit@westonsolutions.com">David.Benoit@westonsolutions.com</a>	(732) 585-4449
Sean Quinn	START V	Weston Solutions, Inc., START V	<a href="mailto:Sean.Quinn@WestonSolutions.com">Sean.Quinn@WestonSolutions.com</a>	(732) 425-1175

### Site-Specific Initial Scoping Meeting Notes/Comments:

Weston Solutions, Inc. Superfund Technical Assessment & Response Team V (START V) has been tasked by the U.S. Environmental Protection Agency, Region II (EPA) with providing field support for the Removal Action (RV2) activities to be conducted at the Holy Trinity Cemetery Site Areas 6 & 7 (the Site) in Lewiston, Niagara County, New York. The scope of work includes daily air monitoring, multimedia sampling including air, soil, and wipes, and radiological screening of concrete and excavated areas.

Air monitoring utilizing DustTracks particulate monitors will consist of continuous, real-time air quality monitoring and data collection. Monitoring locations will be upwind, at areas of intrusive site activity, and downwind. The monitoring stations will be linked via EPA's VIPER system (a wireless network-based communications system) which will provide instantaneous real-time air quality readings through a computer server. The air monitoring data generated will assist in determining if the dust suppression measures being utilized on-site are effective at maintaining dust levels below the Site-Specific Action Levels.

RADēCO volumetric air samplers will be deployed daily and collocated with a DustTrack at each air monitoring station to collect air filter samples which will be analyzed on-site for radioactive dust particles using Ludlum Model 3030 (Ludlum-3030) Alpha Beta counter. Analytical results of air filter samples will be used to verify the effectiveness of dust suppression measures and ensure that Site personnel and nearby residents are not being exposed to site-related airborne contaminants. Up to 30 air filter samples will be collected for the duration of RV2.

Wipe samples will be collected from the exterior surfaces of storage super sacks to verify that any dust particulates on their exterior surfaces do not contain radiological materials above the Site-Specific Action Levels prior to offsite transportation for disposal. Wipe samples will also be collected from decontaminated equipment to verify that decontamination procedures effectively removed all contamination below the Site-Specific Action Levels before removing the equipment from the Site. Up to 50 wipe sample will be collected for the duration of RV2.

### **QAPP Worksheet #9: Project Planning Session Summary (Concluded)**

Post-excavation radiation screening will be performed using the Ludlum-2241 and 3x3 sodium iodide (NaI) scintillator setup prior to post-excavation soil sampling. Post-excavation soil sampling will be performed in accordance with EPA's *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM), and New York State Department of Environmental Conservation (NYSDEC) *Division of Environmental Remediation (DER)-10, Technical Guidance for Site Investigation and Remediation* (May 3, 2010). For safety reasons, and to facilitate excavation backfill, post-excavation soil samples will be analyzed on-site using a High Purity Germanium (HPGe) detector. Subsequently, a percentage of the post-excavation soil samples collected and analyzed with the HPGe will be selected on-Site by the EPA On-Scene Coordinator (OSC) and submitted to EPA's National Analytical Radiation Environmental Laboratory (NAREL) for confirmatory alpha and gamma spectroscopy analyses. The soil samples will be collected for definitive data and quality assurance/quality control (QA/QC) objectives. Field duplicates and additional sample volumes for matrix spike/matrix spike duplicate (MS/MSD) analysis will be collected at a frequency of one per 20 field samples. Rinsate samples will not be collected since dedicated sampling equipment will be utilized. All site activities will be documented in the Site logbook and with photographs. Sample locations will be documented using global positioning system (GPS) technology.

#### **Consensus Decisions Made:**

The Removal Action is scheduled to begin on June 2, 2021 and would last approximately two weeks. Selected post-excavation soil samples will be submitted to NAREL for analysis. The laboratory analytical results of the post-excavation soil samples will be compared against the EPA Site-Specific Action Levels (SSALs) for the target radionuclides and utilized to corroborate the HPGe analytical data.

#### **Action Items:**

Action	Responsible Party	Due Date
Prepare CLP Analytical Request Form	SPM, START V	Not Applicable
Prepare START V Analytical Request Form	SPM, START V	Not Applicable
Develop Health and Safety Plan	SPM, START V	05/28/2021
Develop QAPP	SPM, START V	05/28/2021
Develop Work Plan (driller, sampler, survey, etc.)	SPM, START V	Not Applicable
Develop Equipment List	SPM, START V	05/28/2021
Develop Site-Specific Data Management Plan	SPM, START V	05/28/2021

## **QAPP Worksheet #10: Conceptual Site Model**

### **Background Information:**

The Site consists of approximately 2.91 acres of radionuclide contamination located at a cemetery that is approximately 31.5 acres in size. The Site is owned by Holy Trinity Cemetery of Divine Mercy Parish in Lewiston, Niagara County, New York. The areas of observed contamination in the north-western portion of the property on a relatively flat and slightly elevated grassy field, under existing roadways, and at an isolated area adjacent to the Interstate 190 (I-190) corridor. There is one building on the Site which is utilized as both a residence and a cemetery maintenance facility. The Site is bordered to the north and east by I-190; to the south by Gate of Heaven Cemetery; and to the west by Robert Avenue and a residential area.

Based on historical information, EPA identified nine AOCs at the Site, including six on-site AOCs and three off-site AOCs. The on-site AOCs are identified as Area 1 through Area 4 and Area 8, comprising the grassy open fields and undeveloped portions of the Site, and Area 9, comprising portions of the non-public Site road network. The off-site AOCs are identified as Area 5 through Area 7, comprising three residences located adjacent to the Site, including 5374 Robert Avenue (Area 5), 5380 Robert Avenue (Area 6), and 5382 Robert Avenue (Area 7).

In 1978, the U.S. Department of Energy (DOE) conducted an aerial radiological survey of the Niagara Falls region and identified more than 15 properties having elevated levels of radiation above background levels. It is believed that, in the early 1960s, slag from an unknown source was used as fill on the properties prior to paving. Based on the original survey and subsequent investigations, it is believed that the radioactive slag was deposited on the Site.

In February 1980, the New York State Department of Health (NYSDOH) Bureau of Radiological Health and the Niagara County Health Department conducted a ground radiological survey of the Site to identify areas with elevated radioactivity resulting from the use of radioactive slag as fill on the property. The survey was conducted based on information that the slag used at the cemetery was from the same source used at two other locations in nearby Niagara Falls, which had been identified by the NYSDOH as containing elevated levels of radioactivity. During the survey, cemetery personnel showed NYSDOH a slag pile located near the caretaker's garage in the western portion of the property. Cemetery personnel stated that this slag was used as fill for the cemetery roads throughout the property.

In addition, the slag was used as fill for the base of two proposed roadbeds that extended approximately 500 to 600 feet from the caretaker's garage, northwest toward Robert Avenue. At the time of the survey, the construction of these roads had been abandoned. The underlying slag base was covered with an unknown amount of soil and was left as an open field. Using an Eberline PRM-7 radiation meter, ground radiological survey of the slag pile indicated gamma radiation measuring 250 microrentgens per hour ( $\mu\text{R/hr}$ ) and along cemetery roads, gamma readings ranged from 5  $\mu\text{R/hr}$  (*i.e.*, background concentration) to 30  $\mu\text{R/hr}$ . Gamma readings along the abandoned roadbeds ranged from 200  $\mu\text{R/hr}$  to 400  $\mu\text{R/hr}$ . Samples of the slag were collected as part of the investigation. Laboratory analysis of the samples indicated that the concentrations of isotopic uranium, isotopic thorium, radium-226 (Ra-226), and radium-228 (Ra-228), were significantly higher than background values.

### **QAPP Worksheet #10: Conceptual Site Model (Continued)**

In October 2006, the New York State Department of Environmental Conservation (NYSDEC) and the Niagara County Health Department conducted a reconnaissance of the Site. At the time, the slag pile previously observed near the caretaker's garage was no longer on the Site; the current caretaker had neither knowledge of the slag pile, nor what happened to it. The caretaker also indicated that children living nearby used this area for recreation. Since the 1980 NYSDOH site investigation, trees had grown through the abandoned slag roadbeds, pushing the slag to the surface. As part of the Site visit, NYSDEC conducted a ground radiological survey with an Exploranium GR-135. Radiological measurements taken while walking along the roadbed indicated gamma readings ranging from 200 to 450  $\mu\text{R/hr}$  at waist height (approximately 1 meter/3 feet above the ground) and contact reading (approximately 1 inch above the ground) ranging from 450 to 570  $\mu\text{R/hr}$ . Contact reading taken next to exposed slag near a tree was documented at 700  $\mu\text{R/hr}$ . The NYSDEC collected four slag samples which were analyzed for isotopic uranium and isotopic thorium via gamma-ray spectroscopy. Laboratory analytical results indicated the presence of uranium-238/234 (U-238/234) at concentrations ranging from 114 picocuries per gram (pCi/g) to 1,664 pCi/g and thorium-232 (Th-232) from 114 pCi/g to 898 pCi/g.

In May 2007, NYSDEC visited the Site to verify contamination in an on-site debris pile using gamma-ray spectroscopy. During a 5-minute static survey, Ra-226 was the only radionuclide identified. A similar survey conducted on one of the roadbeds confirmed the presence of Th-232. During a reconnaissance performed by the NYSDOH and NYSDEC in July 2013, a ground radiological survey of on-site roadways and along the back roadway leading off-site was conducted using a pressurized ion chamber (PIC) and a sodium iodide (NaI) 2x2 scintillator. Measurements taken along the roadways with the PIC indicated gamma levels up to 51  $\mu\text{R/hr}$  and up to 50,000 counts per minute (cpm) with the NaI scintillator.

On December 12 and 13, 2013, EPA's contractor, Weston Solutions, Inc., Site Assessment Team (SAT), collected a total of 14 subsurface soil samples and three slag samples from the Site. Soil samples were also collected from two locations suspected to be outside of the source area in order to document background conditions. At each sample location, soil samples were collected directly beneath slag material; at locations where a radioactive fill layer was not visually observed the soil sample was collected at the equivalent depth interval. Each slag sample consisted of one single piece of slag material. The soil samples were analyzed by Test America Laboratories (TestAmerica) for target analyte list (TAL) metals via EPA SW846; isotopic thorium and isotopic uranium via DOE alpha spectroscopy Health and Safety Laboratory (HASL)-300 Method A-01-R; Ra-226, Ra-228, and other gamma emitting radioisotopes via DOE gamma spectroscopy HASL-300 Method GA-01-R. The slag samples were analyzed for the same radiological parameters as the soil samples but were not analyzed for TAL metals. Analytical results indicated that concentrations of radionuclides in all the slag samples and seven soil samples including the field duplicate, were significantly higher than at background conditions.

On May 1, 2014, SAT collected radon and thoron concentration measurements from locations on and in the vicinity of the Site. At the selected locations in background areas, above the source material, and off the source area, radon, and thoron concentration measurements in picocuries per

### **QAPP Worksheet #10: Conceptual Site Model (Continued)**

liter (pCi/L) were collected with RAD7 radon/thoron detectors. The radon and thoron measurements were collected at heights of one meter above the ground surface. Radon and thoron concentrations were at normal background levels.

On August 10 through 13, 2015, EPA and RST 3, currently START V, conducted a Removal Assessment of the Site. The presence/absence of radon, thoron, and gamma radiation was verified through ground radiological surveys. Areas of observed contamination were delineated by comparing radiological survey measurements from suspected source areas with measurements obtained from a background location. Laboratory analytical results were used to verify the concentration of radon in living spaces of the one on-site building and to determine the presence of residual contamination and potential releases of radiation-containing material in soil and fill at the Site. Ground radiological survey measurements were collected on-site using fluke pressurized ionization chamber (FPIC), Ludlum-2241, and Reuter-Stokes high pressure ion chamber (HPIC). To define the basis for comparing ground radiological survey results, it was necessary to establish background reading at the Site. Background readings were collected with each of the instruments from locations on-site that were presumed to be unaffected by historic Site activities. Background gamma measurements included readings collected with Ludlum-2241 (9,900 to 10,700 cpm), FPIC (7 to 16  $\mu\text{R/hr}$  at waist height and 9 to 17  $\mu\text{R/hr}$  at contact), and HPIC (9.52  $\mu\text{R/hr}$ ). Specific isotopes were identified using a Berkeley Nucleonics Corporation (BNC) SAM 940<sup>TM</sup> (SAM 940) portable radioisotope identification system. A Durrige RAD7 electronic radon/thoron detector was utilized to measure the concentration of radon and thoron in ambient air. Background radon/thoron concentrations ranged from 0 to less than (<) 4.0 pCi/L, and no radionuclides were detected with the SAM-940 at the selected background location.

During the August 2015 radiological investigation, gamma measurements taken with the Ludlum-2241 in the one on-site building were generally at background levels, with a few locations indicating gamma readings that were slightly above background. The highest gamma measurement collected in the one on-site building was 16,100 cpm in the viewing room. Gamma measurements taken with the Ludlum-2241 in exterior locations throughout the Site were generally above background, with the highest reading at 569,000 cpm (more than 53 times [53x] above background). Gamma measurements collected with the FPIC in the one on-site building were generally at background levels ranging from 3  $\mu\text{R/hr}$  (at waist height) to 19  $\mu\text{R/hr}$  (at contact). Gamma measurements taken with the HPIC at three locations in the one on-site building ranged from 9.56  $\mu\text{R/hr}$  to 10.94  $\mu\text{R/hr}$ . Exterior HPIC gamma measurements were generally above background. The HPIC gamma measurements collected from eight locations selected on-site for soil sampling ranged from 10.02  $\mu\text{R/hr}$  to 256.34  $\mu\text{R/hr}$  (more than 26x above background). At one location on the east side of the on-site dirt road, Ra-226 was detected with the SAM-940. Based upon results from radon/thoron surveys conducted with RAD7, radon and thoron concentrations were at normal background levels in the on-site building; however, at all eight soil sampling locations, radon concentration was above background in contact measurement collected from one soil sampling location, thoron concentrations were above background in waist-level measurements collected at five soil sampling locations and above background in contact measurements collected at two soil sampling locations.

### **QAPP Worksheet #10: Conceptual Site Model (Continued)**

On August 10 through 13, 2015, RST-3 procured National Radon Safety Board (NRSB)-certified company, Accu-View Property Inspections (Accu-View), utilized passive activated charcoal canisters (radon canisters) to conduct short-term radon sampling tests that lasted a minimum of approximately 72 hours. A total of 15 radon canisters, including two field duplicates, and one field blank, were deployed in the one on-site building. Radon testing locations were focused on frequently occupied spaces in the building. Analytical results indicated that concentrations of radon were below the EPA Site-Specific Action Level (SSAL) of 4.0 pCi/L in all the living spaces sampled in the building.

On August 12, 2015, RST 3 conducted a soil sampling event to verify the presence of residual radioactive material in on-site soil. Based on radiological survey data from SAT's prior site investigation, and survey data from the August 2015 radiological investigation, soil sampling locations suspected to contain radionuclides and metals/metalloids were identified on-site by EPA. A total of nine soil samples, including one field duplicate, were collected at depths 0 to 4 feet below ground surface (bgs) from eight location on-site. The soil samples were analyzed by TestAmerica for TAL metals (including mercury) via EPA SW846; isotopic thorium and isotopic uranium via alpha spectroscopy HASL-300-A-01-R; Ra-226 (21 days ingrowth), Ra-228 and other gamma emitting radioisotopes via gamma spectroscopy HASL-300-GA-01-R. Analytical results indicated that concentrations of Ra-226 exceeded the EPA SSAL (established by EPA in August 2015) of 4.06 pCi/g in three of the nine soil samples. The concentration of cobalt was above the EPA Removal Management Level (RML) of 70 milligrams per kilograms (mg/kg) in one soil sample with exceedance concentration at 110 mg/kg. Thallium concentration was above the EPA RML of 2.3 mg/kg in one soil sample with exceedance concentration at 2.4 mg/kg.

On August 12, 2015, EPA collected four wipe samples including one field blank, from access doorways in the on-site building. The wipe samples were collected to determine if radiation-containing material was being tracked into the building. The wipe samples were analyzed by EPA using Ludlum-3030. Based upon the analytical results of the wipe samples for the selected counting durations, the minimum detectable concentration (MDC) for 100 square centimeters (cm<sup>2</sup>) were determined as 0.80 disintegrations per minute (dpm) and 29.5 dpm respectively, for alpha and beta particles. These levels were below the 100 dpm and 1,000 dpm respectively, for alpha and beta counts outlined in the *New York City* Department of Health and Mental Hygiene (NYC DOHMH) Article 175 of the NYC Health Code, "Radiation Control", §175.03 - Release of Materials or Facilities, which was adopted by EPA as the SSAL for alpha and beta particles. Alpha and beta counts for all the wipe samples were at the natural background level conservatively estimated by counting a blank wipe.

In April 2016, EPA performed Removal Assessment activities at AOCs associated with the Site. Utilizing an all-terrain vehicle (ATV), RST 3 conducted ground radiological survey at seven of the nine AOCs to identify locations indicating presence of radiation-containing material and to define the extent of contamination in the AOCs. Air monitoring and sampling was performed daily at the on-site AOCs during the radiological survey activities to verify that the survey activities being performed on-site were not generating fugitive dust to levels that would potentially expose on-site personnel and the public to site-related contaminants. Based on the results of the ground

### **QAPP Worksheet #10: Conceptual Site Model (Continued)**

radiological survey, approximately 50 percent (%) of Area 1; portions northeast, south, and southwest of Area 2, as well as portions of the non-public Site road network immediately south of Area 2; discontinuous hot spots identified in the southern and southeast portions of Area 3; a dirt pile located on the eastern portion of Area 4; and portions of Area 9 immediately south of Area 1 and Area 3; all indicated gamma readings exceeding 3x background. Gamma readings at Area 5 and Area 8 were at normal background levels. Baseline air monitoring results indicated that particulate concentrations were generally below 50 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ). Daily air monitoring results indicated that particulate concentrations during radiological survey activities were generally below the minimum SSAL of 100  $\mu\text{g}/\text{m}^3$ . Screening results of air filter samples collected with the RADēCO during radiological survey activities indicated that alpha, beta, and gamma particles were at normal background levels.

On April 22 through 24, 2016, RST-3 procured NRSB-certified Company, Accu-View, conducted radon sampling in the residence at Area 5 by to verify if radon was present in living spaces of the residence and, subsequently determine if the installation of a radon mitigation system in the residence was necessary. Analytical results of 12 pre-mitigation radon samples, including one field duplicate, and one field blank, collected from the residence in Area 5 indicated radon concentrations were equal to or exceeded the EPA SSAL of 4.0 picocuries per liter (pCi/L) in five of the samples. Based on the pre-mitigation radon analytical results, on May 24, 2016, EPA conducted a walk-through at Area 5 and identified a location in the residence to install a radon mitigation system. On June 15, 2016, a radon mitigation system was installed in the residence at Area 5. On August 1 through 4, 2016, a post-mitigation radon sampling event was performed to verify the effectiveness of the radon mitigation system in reducing the concentration of radon in the residence. Analytical results of the post-mitigation radon sampling event indicated that radon concentrations were at normal background levels.

On August 18, 2016, RST 3 collected a total of 30 soil samples from seven soil sampling locations identified by the EPA at Area 5. Using non-dedicated hand shovels and pickaxe, test pits were advanced to depths bgs. Soil samples were collected from six locations at depths 0 to 6, 6 to 12, 12 to 18, and 18 to 24 inches bgs, and from one location at depths 2 to 8, 8 to 14, 14 to 20, and 20 to 26 inches bgs. All the soil samples were analyzed by PACE Analytical Services (PACE) for isotopic thorium, isotopic uranium, and other alpha emitting actinides via alpha spectroscopy HASL-300 Method U-02; radium-226 (21-day ingrowth), radium-228, and other gamma emitting radioisotopes via gamma spectroscopy EPA Method 901.1. Analytical results of the 30 soil samples, including two field duplicates, collected from Area 5, indicated that concentrations of target radionuclides were below the EPA SSALs.

On October 14, 2016, RST 3 utilized the Ludlum-2241 and NaI 3x3 scintillator with the VIPER setup to perform exterior radiological survey at two off-site AOCs, Area 6 and Area 7. Background gamma reading was approximately 13  $\mu\text{R}/\text{hr}$ . Radiological survey completed at both AOCs indicated portions of the property boundary between Area 6 and Area 7 had gamma readings ranging from 26  $\mu\text{R}/\text{hr}$  to 39  $\mu\text{R}/\text{hr}$ , which exceeds 2x to 3x background, respectively. Consequently, RST 3 advanced two test pits in Area 6 and one test pit in Area 7 using non-dedicated hand shovels and pickaxes to a depth of 2 feet bgs. at the locations where elevated

### **QAPP Worksheet #10: Conceptual Site Model (Concluded)**

gamma measurements were identified. The soil samples were screened using HPGe and then submitted for laboratory gamma spectroscopy and alpha spectroscopy, analyses. Based on screening and analytical results, concentrations of Ra-226 exceeded the EPA SSAL of 4.06 pCi/g in the soil samples collected from both properties.

On May 12 through 15, 2017, RST 3-procured NRSB-certified company, Accu-View, performed radon sampling in the residences at Area 6 and Area 7. A total of 17 radon canister samples, including one field duplicate (co-located sample), were collected from the residence at Area 6 and a total of 18 radon canister samples, including one field duplicate, were collected from the residence at Area 7. Analytical results of the radon samples collected from both properties were below the EPA Action Level of 4.0 pCi/L for radon.

On May 16, 2017, RST 3 conducted test pit soil sampling at Area 6 and Area 7. Utilizing a mini excavator, one test pit each was advanced to depths 4 feet bgs. at the selected locations in both AOCs. A total of eight heterogeneous samples of soil/slag/rock were collected from the one test pit in Area 6 and nine heterogeneous samples of soil/slag/rock, including one field duplicate, were collected from the one test pit in Area 7. The samples were submitted for laboratory radiochemistry (gamma spectroscopy and alpha spectroscopy) analysis. Based on analytical results, concentrations of Ra-226 exceeded the EPA SSAL of 4.06 pCi/g in the soil samples collected from both properties.

## **QAPP Worksheet #11: Project/Data Quality Objectives**

### **1. State the Problem:**

During previous Site activity, two areas (Areas 6 and 7) indicated elevated Ra-226 levels exceeding the EPA SSAL of 4.06 pCi/g in soil on residential properties. The EPA is conducting a Removal Action to address the contamination at the Site. The selected remedy for the impacted Areas of Concern (AOCs) is the excavation of contaminated soil, backfilling the excavated areas with clean, pre-analyzed soil, and restoring the AOCs as close as reasonably possible to their original state. Prior to backfilling the excavation, START V will conduct post excavation soil sampling to verify that the vertical and horizontal extent of contaminated soil has been removed.

### **2. Identify the Goals of the Study:**

Up to 30 post-excavation soil samples will be collected for analysis from the AOCs in accordance with the MARSSIM protocol for site survey. Analytical results of the post-excavation soil samples will be compared with the Site-Specific Action Level and utilized by EPA to verify that the vertical and horizontal extents of the contamination in the AOCs have been removed.

The soil samples collected from the various AOCs will be screened on-site using the HPGe detector for quantitative gamma spectrometry analysis to determine if the vertical and horizontal extents of the contamination in the AOCs have been removed and expedite backfilling the excavations for safety reasons. Following field screening, a representative fraction of the samples, approximately 10%, will be submitted for laboratory analysis.

If analytical results of post-excavation soil samples indicate concentrations of target radionuclides exceed the Site-Specific Action Level, then EPA will further excavate the location and area from where the post-excavation soil sample was collected, and the location will be re-sampled for verification analysis.

### **3. Identify Information Inputs:**

Up to 30 post-excavation soil samples will be collected and a fraction of the samples, as determined on-site by the EPA OSC, will be submitted to NAREL for alpha and gamma spectroscopy analyses.

### **4. Define the Boundaries of the Study:**

**Overall project objectives include:** The EPA Removal Action is aimed to address the presence of radioactive soil at the Site by excavating the AOCs and backfilling them with clean, pre-analyzed soils. Post excavation soil samples will be collected from the excavated AOCs in accordance with MARSSIM protocols. All the soil samples will be field-analyzed using HPGe detector for quantitative gamma spectrometry analysis and laboratory analytical results will be used to corroborate on-site HPGe soil analytical results.

**Who will use the data?** Data will be used by EPA, Region II OSC.

## **QAPP Worksheet #11: Project/Data Quality Objectives (Continued)**

### **5. Develop the Analytic Approach:**

#### **Analytical Techniques:**

Soil – Isotopic Thorium, Alpha Spectroscopy/NAREL ACT-02F-TH | AM/SOP-41

Soil – Ra-226, Alpha Spectroscopy/NAREL RA-07-EC | AM/SOP-43

Soil – Isotopic Uranium, Alpha Spectroscopy/NAREL ACT-02F-U | AM/SOP-41

Soil – Gamma Spectroscopy/NAREL GAM-01-RA (21-day ingrowth) | AM/SOP-3

**Type of Data:** Definitive data.

**Matrix:** Soil/Air

**Parameters:** Soil samples to be analyzed for isotopic thorium, isotopic uranium, and other gamma emitting isotopes.

#### **Survey/Sampling Equipment:**

Soil - HPGe (screening data, quantitative gamma spectrometry analysis). Soil samples will be collected using dedicated plastic scoops, re-sealable plastic bags, and plastic sample jars.

Air - Ludlum Model 3030 Alpha Beta counter. Air samples will be collected using RADēCO (Model H-810) volumetric air samplers with fiberglass air filter.

**Access Agreement:** To be obtained by EPA Region II OSC.

**How much data are needed?** Up to 30 soil samples collected and QA/QC samples.

### **6. Specify Performance or Acceptance Criteria:**

#### **How “good” does the data need to be in order to support the environmental decision?**

Sampling/analytical measurement performance criteria (MPC) for Precision, Accuracy, Representativeness, Completeness, and Comparability (PARCC) parameters will be established. Refer to Worksheet #12, criteria for performance measurement for definitive data.

**Where, when, and how should the data be collected/generated?** Soil samples for post-excavation analysis will be collected from on-site AOCs starting June 2, 2021. The soil samples will be screened on-site using HPGe detector for quantitative gamma spectrometry analysis, following which a fraction of the samples, as determined by the OSC, will be submitted for laboratory analysis. All field and sampling activities will be performed in accordance with methods outlined in EPA’s Environmental Response Team (ERT)/Scientific, Engineering, Response and Analytical Services (SERAS) contractor’s Standard Operating Procedures (SOPs) and the MARSSIM protocol for site survey.

### **7. Develop the Detailed Plan for Obtaining Data:**

**Who will collect and generate the data?** Soil samples will be collected by START V sampling personnel and analyzed on-Site by START V using HPGe analyzer for screening data. Subsequently, post-excavation soil samples analyzed with the HPGe and selected by the OSC for laboratory analysis will be submitted to NAREL. Soil laboratory analytical data will be generated by NAREL and validated by Weston’s Certified Health Physicist (CHP)/data validation personnel.

**QAPP Worksheet #11: Project/Data Quality Objectives (Concluded)**

**How will the data be reported?** All data will be reported by NAREL (Preliminary, Electronic, and Hard Copy format). The Site Project Manager will provide a Sampling Trip Report, Status Reports, Maps/Figures, Analytical Report, and Data Validation Report to the EPA OSC.

**How will the data be archived?** Electronic data deliverables will be archived in a Scribe database. Non-CLP data will be archived in EPA's document control room.

**QAPP Worksheet #12: Measurement Performance Criteria**  
**QAPP Worksheet #12A – Isotopic Thorium**

**Matrix:** Soil

**Analytical Group/Method:** Isotopic Thorium/Alpha Spectroscopy via NAREL ACT-02FTH

**Concentration Level:** Low

Data Quality Indicators (DQIs)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria <sup>1</sup>
Analytical Precision	Laboratory Sample Duplicates or Laboratory Control Sample Duplicates	$ z\text{-score}  < 3$
Analytical Accuracy/Bias	Laboratory Control Samples	$ z\text{-score}  < 3$
Contamination	Method blank	Refer to 13.1 of QA/QAM-1 on page 57

<sup>1</sup>NAREL Radiochemistry Quality Assurance Manual QA/QAM-1, Revision 11, January 31, 2019.

**QAPP Worksheet #12: Measurement Performance Criteria**  
**QAPP Worksheet #12B – Isotopic Uranium**

**Matrix:** Soil

**Analytical Group/Method:** Isotopic Uranium/Alpha Spectroscopy via NAREL ACT-02F-U

**Concentration Level:** Low

Data Quality Indicators (DQIs)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Analytical Precision	Laboratory Sample Duplicates or Laboratory Control Sample Duplicates	$ z\text{-score}  < 3$
Analytical Accuracy/Bias	Laboratory Control Samples	$ z\text{-score}  < 3$
Contamination	Method blank	Refer to 13.1 of QA/QAM-1 on page 57

<sup>1</sup>NAREL Radiochemistry Quality Assurance Manual QA/QAM-1, Revision 11, January 31, 2019.

**QAPP Worksheet #12: Measurement Performance Criteria**  
**QAPP Worksheet #12C – Radium-226**

**Matrix:** Soil

**Analytical Group/Method:** Radium-226/Alpha Spectroscopy via NAREL RA-07-EC

**Concentration Level:** Low/Medium

Data Quality Indicators (DQIs)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria <sup>1</sup>
Analytical Precision	Laboratory Sample Duplicates or Laboratory Control Sample Duplicates	$ z\text{-score}  < 3$
Analytical Accuracy/Bias	Laboratory Control Samples	$ z\text{-score}  < 3$
Contamination	Method blank	Refer to 13.1 of QA/QAM-1 on page 57

<sup>1</sup>NAREL Radiochemistry Quality Assurance Manual QA/QAM-1, Revision 11, January 31, 2019.

**QAPP Worksheet #12: Measurement Performance Criteria**  
**QAPP Worksheet #12D – Gamma Spectroscopy**

**Matrix:** Soil

**Analytical Group/Method:** Gamma Spectroscopy via NAREL GAM-01-RA

**Concentration Level:** Low

Data Quality Indicators (DQIs)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Analytical Precision	Laboratory Sample Duplicates or Laboratory Control Sample Duplicates	$ z\text{-score}  < 3$
Analytical Accuracy/Bias	Laboratory Control Samples	$ z\text{-score}  < 3$
Contamination	Method blank	Refer to 13.1 of QA/QAM-1 on page 57

<sup>1</sup>NAREL Radiochemistry Quality Assurance Manual QA/QAM-1, Revision 11, January 31, 2019.

### QAPP Worksheet #13: Secondary Data Criteria and Limitations

Sources and types of secondary data include but are not limited to the following:

<b>Data Type</b>	<b>Data Source (originating organization, report title and date)</b>	<b>Data Uses Relative to Current Project</b>	<b>Factors Affecting the Reliability of Data and Limitations on Data Use</b>
EPA Removal Assessment	Weston Solutions, Inc., Removal Assessment Report, 09/19/2019, DCN: STARTV-01-D-0065	To delineate contamination on-site	None
EPA Removal Action	Weston Solutions, Inc., Removal Action (RV2) Sampling Report, 03/30/2021, DCN: STARTV-02-D-0109	Waste characterization	None

### QAPP Worksheet #14 & 16: Project Tasks and Schedules

Activity	Responsible Party	Planned Start Date	Planned Completion Date	Deliverable(s)	Deliverable Due Date
Develop Project-Specific Health and Safety Plan (HASP)	WESTON	5/24/2021	5/26/2020	HASP	5/28/2021
Develop Project-Specific QAPP	WESTON	5/24/2021	5/28/2021	QAPP	5/28/2021
Coordination with EPA Region 2 RSCC for Regional or CLP analytical support or procure WESTON-subcontracted laboratory for analytical services	WESTON	5/24/2021	5/25/2021	Region II RSCC documentation (laboratory assignment) or WESTON Purchase Order for analytical services	NA
Scoping meeting Operations Manager, SPM, HSO, and sampling team to discuss data collection activities, objectives, and logistics	WESTON	5/24/2021	5/24/2021	Meeting Notes	NA
Mobilization/Demobilization	WESTON	6/2/2021	6/15/2021	Field Notes	NA
Sample Collection Tasks	WESTON	6/2/2021	6/15/2021	Field Notes	6/15/2021
Analytical Tasks	NAREL	6/15/2021	8/15/2021	Field Notes/Laboratory Reports	8/15/2021
Quality Control Tasks	NAREL	6/2/2021	8/2/2021	Report of Analyses/Data Package	8/2/2021
Data Validation	WESTON	8/3/2021	8/17/2021	Validation Summary Report	8/17/2021
Summarize Data	WESTON	9/17/2021	9/21/2021	Project-Specific Summary Report/Table	9/21/2021
Develop Project-Specific Report	WESTON	9/21/2021	9/28/2021	Draft Project-Specific Report	9/28/2021
Address EPA comments on Draft Project-Specific Report	WESTON	10/4/2021	10/11/2021	Project-Specific Report	10/11/2021
Contract Closeout	WESTON	12/18/2021	6/30/2022	Contract Closeout Report	6/30/2022

## **QAPP Worksheet #14 & 16: Project Tasks and Schedules (Continued)**

### **Sampling Tasks:**

In accordance with the MARSSIM protocol for site survey, START V will collect up to 30 post-excavation soil samples for analysis from AOCs at the Site. All the soil samples collected will be screened on-site using HPGe detector for quantitative gamma spectrometry analysis, following which a representative fraction of the samples, as determined by the OSC, will be submitted to NAREL for analyses.

### **Analysis Tasks:**

Soil – Isotopic Thorium, Alpha Spectroscopy/NAREL ACT-02F-TH | AM/SOP-41

Soil – Ra-226, Alpha Spectroscopy/NAREL RA-07-EC | AM/SOP-43

Soil – Isotopic Uranium, Alpha Spectroscopy/NAREL ACT-02F-U | AM/SOP-41

Soil – Gamma Spectroscopy/NAREL GAM-01-RA (21-day ingrowth) | AM/SOP-3

### **Decontamination:**

Soil samples will be collected using dedicated sampling equipment; therefore, no rinsate blank will be collected.

### **Quality Control Tasks:**

For soil samples designated for laboratory analysis, field samples will be collected for definitive data and QA/QC purposes, field duplicates and additional sample volumes for MS/MSD analysis will be collected at a frequency of one per 20 field samples per matrix.

### **Data Management Tasks:**

Activities under this project will be reported in status and trip reports and other deliverables (e.g., analytical reports, final reports) described herein. Activities will also be summarized in appropriate format for inclusion in monthly and annual reports. The following deliverables will be provided under this project:

Trip Report: A trip report will be prepared to provide a detailed accounting of what occurred during each sampling mobilization. The trip report will be prepared within two weeks of the last day of each sampling mobilization. Information will be provided on time of major events, dates, and personnel on-site (including affiliations).

Maps/Figures: Maps depicting site layout, contaminant source areas, and sample locations will be included in the trip report, as appropriate.

Analytical Report: An analytical report will be prepared for samples analyzed under this plan. Information regarding the analytical methods or procedures employed, sample results, QA/QC results, chain-of-custody documentation, laboratory correspondence, and raw data will be provided within this deliverable.

Data Review: A review of the data generated under this plan will be undertaken. The assessment of data acceptability or usability will be provided separately, or as part of the analytical report.

## **QAPP Worksheet #14 & 16: Project Tasks and Schedules (Continued)**

### **Documentation and Records:**

All sample documents will be completed legibly, in ink. Any corrections or revisions will be made by lining through the incorrect entry and by initialing the error.

Field Logbook: The field logbook is essentially a descriptive notebook detailing site activities and observations so that an accurate account of field procedures can be reconstructed in the writer's absence. Field logbook will be bound and paginated. All entries will be dated and signed by the individuals making the entries, and should include (at a minimum) the following

1. Site name and project number
2. Name(s) of personnel on-site
3. Dates and times of all entries (military time preferred)
4. Descriptions of all site activities, site entry and exit times
5. Noteworthy events and discussions
6. Weather conditions
7. Site observations
8. Sample and sample location identification and description \*
9. Subcontractor information and names of on-site personnel
10. Date and time of sample collections, along with chain of custody information
11. Record of photographs
12. Site sketches
13. GPS Coordinates for each sample location

\* The description of the sample location will be noted in such a manner as to allow the reader to reproduce the location in the field at a later date.

### **QAPP Worksheet #14 & 16: Project Tasks and Schedules (Concluded)**

Sample Labels: Sample labels will clearly identify the particular sample, and should include the following:

1. Site/Project number
2. START V Sample identification number.
3. Sample collection date and time
4. Analytical Parameters
5. Sample preservation

Sample labels will be written in indelible ink and securely affixed to the sample container. Tie-on labels can be used if properly secured.

Custody Seals: Custody seals demonstrate that a sample container has not been tampered with or opened. The individual in possession of the sample(s) will sign and date the seal, affixing it in such a manner that the container cannot be opened without breaking the seal. The name of this individual, along with a description of the sample packaging, will be noted in the field logbook.

**Assessment/Audit Tasks:** No performance audit of field operations is anticipated at this time. If conducted, performance and system audit will be in accordance with the project plan.

**Data Review Tasks:** All soil sample analytical data will be validated by Weston CHP/data validator.

The data generated under this QA/QC Sampling Plan will be evaluated according to guidance in the Uniform Federal Policy for Implementing Environmental Quality Systems: Evaluating, Assessing and Documenting Environmental Data Collection and Use Programs Part 1: UFP-QAPP (EPA-105-B-04-900A, March 2005); Part 2B: Quality Assurance/Quality Control Compendium: Minimum QA/QC Activities (EPA-105-B-04-900B, March 2005). Laboratory analytical results will be assessed by the data reviewer for compliance with required precision, accuracy, completeness, representativeness, and sensitivity.

**QAPP Worksheet #15: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits**  
**QAPP Worksheet #15A – Isotopic Thorium**

**Matrix:** Soil

**Analytical Group/Method:** Isotopic Thorium/Alpha Spectroscopy

Soil: NAREL ACT-02F-TH / Aqueous: NAREL ACT-01-TH

**Concentration Level:** Low/Medium

Analyte	CAS Number	Site-Specific Action Level (pCi/g)	Project Quantitation Limit	Method CRQLs (Units)	NAREL Method Detection Limit (Units)
Thorium-227 (Th-227)	15623-47-9	NS	NA	NA	*
Thorium-228 (Th-228)	14274-82-9	31,000	NA	NA	*
Thorium-230 (Th-230)	14269-63-7	6,160	NA	NA	0.14 pCi/g
Thorium-232 (Th-232)	7440-29-1	2.88	NA	NA	0.10 pCi/g

\*NAREL does not provide MDC for Th-227 and Th-228  
pCi/g – Picocuries per gram  
NA – Not Applicable

**QAPP Worksheet #15: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits**  
**QAPP Worksheet #15B – Isotopic Uranium**

**Matrix:** Soil

**Analytical Group/Method:** Isotopic Uranium/Alpha Spectroscopy

Soil: NAREL ACT-02F-U / Aqueous: NAREL ACT-01-U

**Concentration Level:** Low/Medium

Analyte	CAS Number	Site-Specific Action Level (pCi/g)	Project Quantitation Limit	Method CRQLs (Units)	NAREL Method Detection Limit (Units)
Uranium-234 (U-234)	13966-29-5	10,300	NA	NA	0.10 pCi/g
Uranium-235 (U-235)	15117-96-1	60.9	NA	NA	0.12 pCi/g
Uranium-238 (U-238)	7440-61-1	3.85	NA	NA	0.10 pCi/g

pCi/g – Picocuries per gram

NA – Not Applicable

**QAPP Worksheet #15: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits**  
**QAPP Worksheet #15C – Gamma Spectroscopy**

**Matrix:** Soil

**Analytical Group/Method:** Gamma Spectroscopy/NAREL GAM-01-RA

**Concentration Level:** Low/Medium

Analyte	CAS Number	Site-Specific Action Level (pCi/g)	Project Quantitation Limit	Method CRQLs (Units)	NAREL Method Detection Limit (Units)
Actinium-228 (Ac-228)	14331-83-0	2.88	NA	NA	01 pCi/g
Bismuth-207 (Bi-207)	13982-38-2	NS	NA	NA	**
Bismuth-212 (Bi-212)	14913-49-6	10,400,000	NA	NA	0.1 pCi/g
Bismuth-214 (Bi-214)	14733-03-0	2,110,000	NA	NA	0.1 pCi/g
Cesium-137 (Cs-137)	10045-97-3	18	NA	NA	0.1 pCi/g
Europium-155 (Eu-155)	14391-16-3	NS	NA	NA	**
Potassium-40 (K-40)	13966-00-2	43	NA	NA	0.2 pCi/g
Protactinium-234M (Pa-234M)	15100-28-4	3.85	NA	NA	NS
Lead-210 (Pb-210)	14255-04-0	NS	NA	NA	1.0 pCi/g
Lead-212 (Pb-212)	7439-92-1	1,060,000	NA	NA	0.1 pCi/g
Lead-214 (Pb-214)	15067-28-4	11,800,000	NA	NA	0.1 pCi/g
Radium-224 (Ra-224)	13233-32	1,400,000	NA	NA	NS
Radium-226 (Ra-226)*	13982-63-3	1.79	NA	NA	0.1 (Bi/Pb-214) pCi/g
Radium-228 (Ra-228)	15262-20-1	2.88	NA	NA	0.1 (Ac-228) pCi/g
Thorium-234 (Th-234)	15065-10-8	76,700	NA	NA	1.0 pCi/g
Thallium-208 (Tl-208)	14913-50-9	5,470,000	NA	NA	0.1 pCi/g

\*Ra-226 via 21 day ingrowth

\*\*NAREL uses Bi-207 and Eu-155 in the gamma LCSs, and therefore does not report these nuclides in samples.

pCi/g – Picocuries per gram

NA – Not Applicable

NS – Not Specified

## **QAPP Worksheet #17: Sampling Design and Rationale**

All field sampling activities will be performed in accordance with EPA's ERT/SERAS contractor's SOP Number (No.): 2001: *General Field Sampling Guidelines*. This sampling design is based on information currently available and may be modified on-site in light of field screening results and other acquired information.

### **Air Sampling:**

Air sampling will be conducted daily for the duration of intrusive activity. At each air monitoring station there will be a RADēCO (Model H-810) volumetric air samplers calibrated by the manufacturer and equipped with replaceable filter media. Each air sampler contains a 2-inch filter holder with a RADēCO (0750-37) glass fiber air filter. The air samplers will be set to collect air filter samples at a flow rate of 5 cubic feet per minute (cfm) for a target volume of 2,400 cubic feet (cf) over an approximately 8-hour period. Each day, the air samplers will be calibrated using the RADēCO Air Calibrator (Model D-828) prior to being deployed. Calibration readings will be recorded using the RADēCO Model H-810 Calibration Functional Check Form F001 or documented in the Site logbook. Calibration forms/information will be reviewed and maintained on-site by the EPA Health Physicist (HP) prior to air sampler being used in the field.

Each RADēCO unit will be mounted on a tripod stand, powered with an electric generator, and positioned in an opposing wind direction. Air filter samples will be collected daily from perimeter air monitoring locations upon initiation of intrusive Site activities and periodically as needed depending on changes in Site conditions, expected elevated contaminant concentrations in soils being excavated, and if analytical results of previous air samples indicate there is a need for further sampling. All air filter samples collected will be placed in a glassine envelop before being placed in a re-sealable plastic bag. Air sampling information, including date, start and stop time, start and ending flow rates, and total volume will be entered into the Site-Specific Scribe sample management database from which sample labels and COC record will be generated using the Scribe software. The sample label will be placed on the re-sealable plastic bag for each air sample, and documentation associated with the samples, including COCs, will be kept with the samples until relinquished to the field measurement personnel. The samples will be analyzed on-site by field measurement personnel using a Ludlum (Model 3030) Alpha Beta counter.

### **Wipe Sampling:**

Wipe sampling will be conducted in accordance with EPA's ERT/SERAS contractor's SOP No. 2011: *Chip, Wipe and Sweep Sampling*. Wipe samples will be collected from the exterior of cubic yard boxes and super sacks in order to verify that any dust particulates on the exterior surfaces do not contain radiological materials above the Site-Specific Action Levels prior to offsite disposal. Wipe samples will also be collected from decontaminated equipment to verify that decontamination procedures effectively removed all contamination below Site-Specific Action Levels before removing the equipment from the Site. Each wipe sample will be collected within a 100 square centimeters (cm<sup>2</sup>) sampling template. Donning new nitrile gloves, the wipe sampling media (*i.e.*, ghost wipe) will be opened and stroked firmly over the sample surface in a reproducible pattern, first vertically, then horizontally, to ensure complete coverage. The wipe sample will be folded and placed into a re-sealable plastic bag and labelled. All sample information will be

### QAPP Worksheet #17: Sampling Design and Rationale (Concluded)

entered into the Site-Specific Scribe sample management database from which COC record and sample labels will be printed using the Scribe software. All the wipe samples will be analyzed on-site by the EPA HP using Ludlum-3030.

#### **Post-Excavation Soil Sampling:**

Post-excavation soil sampling will be performed in accordance with EPA's ERT/SERAS contractor's SOP No. 2012: *Soil Sampling*, EPA's MARSSIM and NYSDEC DER-10. At a minimum, post-excavation soil samples will be collected at a frequency of one sidewall soil sample per 30 linear feet of the excavation perimeter and one bottom soil sample at a frequency of one per 900 square feet (sq. ft). Post-excavation samples will be collected using dedicated disposable scoops, and fresh nitrile gloves will be donned between each sampling location. Prior to sample collection at each location, the bottom of the scoop will be used to scrape each area of the sidewall and floor, in order to expose fresh soil which will then be collected, placed directly into re-sealable plastic bags, homogenized in the plastic bags, and then placed into polyurethane or glass sample containers. Since dedicated sampling equipment will be utilized, rinsate blank will not be required. The samples will be analyzed on-site using the HPGe detector. Subsequently, a fraction of the soil samples analyzed with the HPGe will be selected, as determined by the OSC, for laboratory analysis. Samples designated for laboratory analysis will be collect for definitive data and QA/QC purposes. All sample information will be entered into the Site-Specific Scribe sample management database from which chain of custody (COC) record and sample labels will be printed using the Scribe software. The post-excavation soil samples selected for laboratory analysis will be submitted to NAREL for confirmatory radiochemistry (gamma spectroscopy and alpha spectroscopy) analyses.

The following laboratories will provide the analyses indicated:

Lab Name/Location/Contact	Matrix	Parameters
National Analytical Radiation Environmental Laboratory (NAREL) 540 South Morris Avenue, Montgomery, AL 36115 Attn: Tonya Hudson Phone: 334-270-3433	Soil	Alpha Spectroscopy/Isotopic thorium Alpha Spectroscopy/Isotopic uranium Alpha Spectroscopy/Radium-226 Gamma Spectroscopy: Ra-226 and Ra-228 via 21-day ingrowth

Refer to Worksheet #20 for QA/QC samples, sampling methods, and SOPs.

### QAPP Worksheet #18: Sampling Locations and Methods/SOP Requirements Table

The following information is project-specific and will be included in the site-specific QAPP.

Sampling Location	Matrix	(Units)	Sample Type No. of Samples (identify field duplicates)	Analyte/Analytical Group(s)	Sampling SOP Reference <sup>1</sup>	Comments
Up to 28	Soil	pCi/g	30 (2)	Isotopic thorium, isotopic uranium, Ra-226, and other gamma emitting isotopes	SOP# 2001, 2012	Confirmation of the complete removal of contaminated soil

pCi/g – Picocuries per gram

The website for EPA-ERT SOPs is: [https://response.epa.gov/site/site\\_profile.aspx?site\\_id=2107](https://response.epa.gov/site/site_profile.aspx?site_id=2107)

### QAPP Worksheet #19 & 30: Sample Containers, Preservation, and Hold Times

**Laboratory:** NAREL, 540 South Morris Avenue, Montgomery, AL 36115

**POC:** Tonya Hudson, Phone: 334-270-3433, Email: [hudson.tonya@epa.gov](mailto:hudson.tonya@epa.gov)

**List Any Required Accreditations/Certifications:** Not applicable.

**Back-up Laboratory:** Not Applicable

**Sample Delivery Method:** Fed Ex

Matrix	Analytical Group	Analytical and Preparation Method/SOP Reference <sup>1</sup>	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)	Data Package Turnaround Time
Soil	Isotopic Thorium	NAREL ACT-02F-TH	32 oz Plastic Jar (wide mouth)	None	None	60 days
Soil	Isotopic Uranium	NAREL ACT-02F-U				
Soil	Radium-226	NAREL RA-07-EC				
Soil	Other Gamma Isotopes	NAREL GAM-01-RA (21-day ingrowth)				

\*1,000 grams total soil for gamma, U, & TH will be enough. Plastic jars or doubled Ziplock bags are preferred to glass.

### QAPP Worksheet #20: Field Quality Control Sample Summary

Matrix	Analytical Group	No. of Field Samples <sup>1</sup>	No. of Field Duplicates	No. of Extra Volume Laboratory QC (e.g., MS/MSD) Samples	No. of Field Blanks	No. of Equip. Blanks	No. of Trip. Blanks	No of others	Total No. of Samples to Lab
Soil	Isotopic Thorium	Up to 28	2	2	NR	NR	NR	NR	30
Soil	Isotopic Uranium	Up to 28	2	2	NR	NR	NR	NR	30
Soil	Radium-226	Up to 28	2	2	NR	NR	NR	NR	30
Soil	Other Gamma Isotopes	Up to 28	2	2	NR	NR	NR	NR	30

NR – Not Required

### QAPP Worksheet #21: Project Sampling SOP References Table

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comment
SOP#: 2001	General Field Sampling Guidelines (all media); Rev. 0.1, June 7, 2013	ERT/SERAS	Site-Specific	N	NA
SOP#: 2012	Soil Sampling; Rev. 0.1, July 11, 2001	ERT/SERAS	plastic scoops, aluminum trays, and appropriate sample jars	N	NA
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual, August 2000	NUREG/EPA/DOE	Plastic scoops, re-sealable plastic bags, and glass sample jars	N	NA

See Attachment B for EPA's ERT/SERAS SOP #s 2001, 2012, and MARSSIM.

The website for EPA's ERT/SERAS SOPs is: [https://response.epa.gov/site/site\\_profile.aspx?site\\_id=2107](https://response.epa.gov/site/site_profile.aspx?site_id=2107)

The website for MARSSIM is: <https://www.epa.gov/radiation/download-marssim-manual-and-resources>

### QAPP Worksheet #22: Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Calibration Activity	Maintenance Activity	Testing/ Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Trimble® GeoXT™ handheld GPS unit	Factory-calibrated by Manufacturer	Charge battery when low	Confirm optimum satellite reception and battery status	Charge battery at least daily	Unit should receive communication from at least 5 satellites	Charge battery when low or replace battery if it does not hold charge	Equipment Vendor	Not applicable
HPGE	Performed by EPA	Performed by EPA	Performed by EPA	Performed by EPA	Performed by EPA	Performed by EPA	Performed by EPA	Not applicable
*Ludlum Model 2241 with 2x2 Gamma Scintillator	EPA Region II Equipment Office	EPA Region II Equipment Office	EPA Region II Equipment Office	EPA Region II Equipment Office	EPA Region II Equipment Office	EPA Region II Equipment Office	EPA Region II Equipment Office	Not applicable
*Ludlum 3030 with check sources	EPA Region II Equipment Office	EPA Region II Equipment Office	EPA Region II Equipment Office	EPA Region II Equipment Office	EPA Region II Equipment Office	EPA Region II Equipment Office	EPA Region II Equipment Office	Not applicable

\*Equipment to be provided, calibrated, maintained, tested, and inspected by EPA.

### QAPP Worksheet #23: Analytical SOPs

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
AM/SOP-41 (Soil)	NAREL ACT-02F-TH	Definitive Data	Soil	Alpha Spectroscopy	NAREL	N
AM/SOP-41 (Soil)	NAREL ACT-02F-U	Definitive Data	Soil	Alpha Spectroscopy	NAREL	N
AM/SOP-43 (Soil)	NAREL RA-07-EC	Definitive Data	Soil	Alpha Spectroscopy	NAREL	N
AM/SOP-3	NAREL GAM-01-RA	Definitive Data	Soil	Gamma Spectroscopy	NAREL	N

### QAPP Worksheet #24: Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
HPGe	See Section 10.0 of SOP 9 (NC/SOP-10)	5 years	Delta values of $\pm 5\%$ for FWHM & Efficiency Delta values of $\pm 0.3\%$ for energy	Root Cause Analysis Correct problem, recalibrate, and re-analyze any affected samples	Instrument Administrator	NC/SOP-10
Alpha Spectrometers	Refer to NC/SOP-8 Section 10	5 years	Refer to NC/SOP-8 Section 10.5	Root Cause Analysis	Instrument Administrator	NC/SOP-8

### QAPP Worksheet #25: Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing/Inspection Activity	Frequency	Acceptance Criteria	Corrective Action (CA)	Responsible Person for CA	SOP Reference <sup>1</sup>
HPGe	As per instrument manufacturer's recommendations	Contamination Check	Weekly + each day before & after detector is used	Control Chart Limits	Root Cause Analysis Correct problem, recalibrate, and re- analyze any affected samples	Instrument Administrator	AM/SOP-3
HPGe	As per instrument manufacturer's recommendations	QC Check	Weekly + each day before & after detector is used	Energy - $\pm 1$ keV FWHM – 30% above & below the mean Efficiency – control chart limits	Root Cause Analysis Correct problem, recalibrate, and re- analyze any affected samples	Instrument Administrator	AM/SOP-3
Alpha Spectrometers	As per instrument manufacturer's recommendations	Background	Biweekly	Control Charted	Root Cause Analysis	Instrument Administrator	NC/SOP-8
Alpha Spectrometers	As per instrument manufacturer's recommendations	Eff. Check	Weekly	Control Charted FWHM – 30% above & below the mean Efficiency – control chart limits	Root Cause Analysis	Instrument Administrator	NC/SOP-8

### QAPP Worksheet #26 & 27: Sample Handling, Custody, and Disposal

**Sampling Organization:** Weston Solutions, Inc., START V

**Laboratory:** Soil/NAREL

**Method of sample delivery (shipper/carrier):** Hand Delivered or FedEx

**Number of days from reporting until sample disposal:** To Be Determined by EPA OSC

Activity	Organization and Title or Position of Person Responsible for the Activity	SOP Reference <sup>1</sup>
Sample Labeling	START V Site Project Manager, START V Sampling Team	EPA-540-R-014-013, October 2014
Chain-of-Custody Form Completion	START V Site Project Manager, START V Sampling Team	EPA-540-R-014-013, October 2014
Sample Packaging	START V Site Project Manager, START V Sampling Team	EPA-540-R-014-013, October 2014
Shipping Coordination	START V Site Project Manager, START V Sampling Team	EPA-540-R-014-013, October 2014
Sample Receipt, Inspection, & Log-in	Laboratory Sample Custodian	EPA-540-R-014-013, October 2014, NAREL
Sample Custody and Storage	Laboratory Sample Custodian / Laboratory Analytical Personnel	EPA-540-R-014-013, October 2014, NAREL
Sample Disposal	EPA OSC, Region II / Field Personnel / Laboratory Sample Custodian / Laboratory Analytical Personnel	EPA-540-R-014-013, October 2014, NAREL

**Sample Identification Procedures:** Each soil sample collected by START V will be designated by a code that will identify the sample in accordance with previous sampling (if applicable). An alpha-numeric code that identifies the Site and Removal Phase will begin the sample naming nomenclature for all post-excavation soil samples, followed by an alpha-numeric code that combines media type and sample location, and then the sample depth interval. After the sample depth, the sequential sample numbers will be listed. Field duplicates will be identified in the same manner as other samples and will be distinguished and documented in the field logbook.

Example Soil Sample: HTCRV2-SSW01-0612-01

HTCRV2 = Holy Trinity Cemetery Removal Phase 2, SSW01 = sidewall soil sample location 01, Soil sample collected from depths 6 to 12 inches bgs (0612), Sample number 01, Field Duplicate will be 02.

Example Soil Sample: HTCRV2E-SSB01-SS0024-01

HTCRV2 = Holy Trinity Cemetery Removal Phase 2, SSB01 = Base/bottom soil sample location 01, Soil sample collected from a depth of 24 inches bgs (0024), Sample number 01, Field Duplicate will be 02.

NOTE: Sample naming nomenclature for other sample matrices that are not property specific (i.e., air, wipe, and concrete) will be determined on-site by the OSC.

### **QAPP Worksheet #26 & 27: Sample Handling, Custody, and Disposal (Concluded)**

**Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory):** Each sample will be individually identified and labeled after collection, then sealed with custody seals and enclosed in a plastic cooler. The sample information will be COC forms, and the samples shipped to the appropriate laboratory via overnight delivery service or courier. Chain-of-custody records must be prepared in Scribe to accompany samples from the time of collection and throughout the shipping process. Each individual in possession of the samples must sign and date the sample COC Record. The chain-of-custody record will be considered completed upon receipt at the laboratory. A traffic report and chain-of-custody record will be maintained from the time the sample is taken to its final deposition. Every transfer of custody must be noted and signed for, and a copy of this record kept by each individual who has signed. When samples are not under direct control of the individual responsible for them, they must be stored in a locked container sealed with a custody seal. Specific information regarding custody of the samples projected to be collected on the weekend will be noted in the field logbook. The chain-of-custody record should include (at minimum) the following: 1) Sample identification number; 2) Sample information; 3) Sample location; 4) Sample date; 5) Sample Time; 6) Sample Type Matrix; 7) Sample Container Type; 8) Sample Analysis Requested; 9) Name(s) and signature(s) of sampler(s); and 10) Signature(s) of any individual(s) with custody of samples.

A separate chain-of-custody form must accompany each cooler for each daily shipment. The chain-of-custody form must address all samples in that cooler, but not address samples in any other cooler. This practice maintains the chain-of-custody for all samples in case of mis-shipment.

**Laboratory Sample Custody Procedures (receipt of samples, archiving, and disposal)** Within the laboratory, the person responsible for sample receipt must sign and date the chain-of-custody form; verify that custody seals are intact on shipping containers; compare samples received against those listed on the chain-of-custody form; examine all samples for possible shipping damage and improper sample preservation; note on the chain-of-custody record that specific samples were damaged; notify sampling personnel as soon as possible so that appropriate samples may be regenerated; verify that sample holding times have not been exceeded; maintain laboratory chain-of-custody documentation; and place the samples in the appropriate laboratory storage. At this time, no samples will be archived at the laboratory. Disposal of the samples will occur only after analyses and QA/QC checks are completed.

<sup>1</sup>Note: Refer to Contract Laboratory Program Guidance for Field Samplers, EPA-540-R-014-013, October 2014 at:  
[https://www.epa.gov/sites/production/files/2015-03/documents/samplers\\_guide.pdf](https://www.epa.gov/sites/production/files/2015-03/documents/samplers_guide.pdf)

**QAPP Worksheet #28: QC Samples Table**  
**QAPP Worksheet #28A – Isotopic Thorium**

<b>Matrix</b>	Soil
<b>Analytical Group</b>	Isotopic Thorium
<b>Concentration Level</b>	Low/Medium
<b>Sampling SOP(s)</b>	ERT/SERAS SOP# 2001, 2012
<b>Analytical Method/SOP Reference</b>	Alpha Spectroscopy NAREL ACT-02F-TH / AM/SOP-41 (Soil)
<b>Sampler's Name</b>	Thomas O'Donnell / David Benoit
<b>Field Sampling Organization</b>	Weston Solutions, Inc., START V
<b>Analytical Organization</b>	NAREL
<b>No. of Sample Locations</b>	28

<b>Lab QC Sample:</b>	<b>Frequency/ Number</b>	<b>Method/SOP QC Acceptance Limits</b>	<b>Corrective Action</b>	<b>Person(s) Responsible for Corrective Action</b>	<b>Data Quality Indicator (DQI)</b>	<b>Measurement Performance Criteria</b>
Duplicate	1 per 20	$ z\text{-score}  < 3$	Reanalysis	Analyst	Precision	$ z\text{-score}  < 3$
Laboratory Control	1 per 20	$ z\text{-score}  < 3$	Reanalysis	Analyst	Accuracy	$ z\text{-score}  < 3$
Reagent Blank	1 per 20	$0 \pm 3 \text{ sigma}$	Reanalysis	Analyst	Precision	$0 \pm 3 \text{ sigma}$

**QAPP Worksheet #28: QC Samples Table**  
**QAPP Worksheet #28B – Isotopic Uranium**

<b>Matrix</b>	Soil
<b>Analytical Group</b>	Isotopic Uranium
<b>Concentration Level</b>	Low/Medium
<b>Sampling SOP(s)</b>	ERT/SERAS SOP# 2001, 2012
<b>Analytical Method/SOP Reference</b>	Alpha Spectroscopy NAREL ACT-02F-U / AM/SOP-41 (Soil)
<b>Sampler's Name</b>	Thomas O'Donnell / David Benoit
<b>Field Sampling Organization</b>	Weston Solutions, Inc., START V
<b>Analytical Organization</b>	NAREL
<b>No. of Sample Locations</b>	28

Lab QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Duplicate	1 per 20	$ z\text{-score}  < 3$	Reanalysis	Analyst	Precision	$ z\text{-score}  < 3$
Reagent Blank	1 per 20	$0 \pm 3$ sigma	Reanalysis	Analyst	Accuracy	$0 \pm 3$ sigma
Duplicate	1 per 20	$ z\text{-score}  < 3$	Reanalysis	Analyst	Precision	$ z\text{-score}  < 3$

**QAPP Worksheet #28: QC Samples Table**  
**QAPP Worksheet #28C – Radium-226**

<b>Matrix</b>	Soil
<b>Analytical Group</b>	Radium-226
<b>Concentration Level</b>	Low/Medium
<b>Sampling SOP(s)</b>	ERT/SERAS SOP# 2001, 2012
<b>Analytical Method/SOP Reference</b>	Alpha Spectroscopy NAREL RA-07-EC / AM/SOP-43
<b>Sampler's Name</b>	Thomas O'Donnell / David Benoit
<b>Field Sampling Organization</b>	Weston Solutions, Inc., START V
<b>Analytical Organization</b>	NAREL
<b>No. of Sample Locations</b>	28

Lab QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Duplicate	1 per 20	$ z\text{-score}  < 3$	Reanalysis	Analyst	Precision	$ z\text{-score}  < 3$
Reagent Blank	1 per 20	$0 \pm 3$ sigma	Reanalysis	Analyst	Accuracy	$0 \pm 3$ sigma
Duplicate	1 per 20	$ z\text{-score}  < 3$	Reanalysis	Analyst	Precision	$ z\text{-score}  < 3$

**QAPP Worksheet #28: QC Samples Table**  
**QAPP Worksheet #28D – Gamma Spectroscopy**

<b>Matrix</b>	Soil
<b>Analytical Group</b>	Gamma Spectroscopy
<b>Concentration Level</b>	Low/Medium
<b>Sampling SOP(s)</b>	ERT/SERAS SOP# 2001, 2012
<b>Analytical Method/SOP Reference</b>	Gamma Spectroscopy NAREL GM-01-RA / AM/SOP-3 (Soil)
<b>Sampler's Name</b>	Thomas O'Donnell / David Benoit
<b>Field Sampling Organization</b>	Weston Solutions, Inc., START V
<b>Analytical Organization</b>	NAREL
<b>No. of Sample Locations</b>	28

Lab QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Duplicate	1 per 20	z-score   < 3	Reanalysis	Analyst	Precision	z-score   < 3
Laboratory Control	1 per 20	z-score   < 3	Reanalysis	Analyst	Accuracy	z-score   < 3
Reagent Blank	1 per 20	0 ± 3 sigma	Reanalysis	Analyst	Precision	0 ± 3 sigma

### QAPP Worksheet #29: Project Documents and Records

Sample Collection and Field Records			
Record	Generation	Verification	Storage Location/Archival
Field Logbook or Data Collection Sheets	SPM/Field Personnel	Group Leader or Operations Manager	Project File
Chain-of-Custody Forms	SPM/Field Personnel	Group Leader or Operations Manager	Project File
Custody Seals	SPM/Field Personnel	Group Leader or Operations Manager	Project File
Air Bills	SPM/Field Personnel	Group Leader or Operations Manager	Project File
Daily QC Reports	SPM	Group Leader or Operations Manager	Project File
Deviations	SPM/Field Scientist	Group Leader or Operations Manager	Project File
Corrective Action Reports	Delegated QA Manager	Operations Manager or Program Manager or designee	Project File
Correspondence	SPM	Delegated QA Manager	Project File
Field Sample Results/Measurements	SPM/Field Scientist	Delegated QA Manager	Project File
Tailgate Safety Meeting Items	SPM/Field Safety Officer	Delegated QA Manager	Project File

Project Assessments			
Record	Generation	Verification	Storage Location/Archival
Data Verification Checklists	Data validator/Chemist QA/QC Specialist	Group Leader or Operations Manager	Project File
Data Validation Report	Data validator/Chemist QA/QC Specialist	Group Leader or Operations Manager	Project File
Data Usability Assessment Report	Site Project Manager	Group Leader or Operations Manager	Project File
Corrective Action Reports	Group Leader/HSO/Chemist QA/QC Specialist	Group Leader	Project File
Correspondence	Group Leader/HSO/Chemist QA/QC Specialist	Program Manager or designee	Project File

### QAPP Worksheet #29: Project Documents and Records (Concluded)

Laboratory Records			
Record	Generation	Verification	Storage Location/Archival
Sample Receipt, Custody, and Checklist	Laboratory Sample Receiving	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Equipment Calibration Logs	Laboratory Technician	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Standard Traceability Logs	Laboratory Technician	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Sample Prep Logs	Laboratory Technician	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Run Logs	Laboratory Technician	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Equipment Maintenance, Testing, and Inspection Logs	Laboratory Technician/ Laboratory QA Manager	Laboratory PM/Delegated QA Manager	Laboratory File
Corrective Action Reports	Laboratory QA Manager	Laboratory PM/Delegated QA Manager	Laboratory File and Project File
Laboratory Analytical Results	Laboratory Technician/ Laboratory QA Manager	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Laboratory QC Samples, Standards, and Checks	Laboratory Technician/ Laboratory QA Manager	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Instrument Results (raw data) for Primary Samples, Standards, QC Checks, and QC Samples	Laboratory Technician/ Laboratory QA Manager	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Sample Disposal Records	Laboratory Technician	Laboratory PM/Delegated QA Manager	Laboratory File

Laboratory Data Deliverables <sup>1</sup>						
Record	VOCs	SVOCs	PCBs	Pesticides	Metals	Other <sup>2</sup>
Narrative	NA	NA	NA	NA	NA	Y
Chain of Custody	NA	NA	NA	NA	NA	Y
Summary Results	NA	NA	NA	NA	NA	Y
QC Results	NA	NA	NA	NA	NA	Y
Chromatograms or raw data	NA	NA	NA	NA	NA	Y
Tentatively Identified Compounds	NA	NA	NA	NA	NA	Y

<sup>1</sup> The blank Laboratory Data Deliverables table is designed to be a checklist for use in supporting data completeness. The records and analytical groups in this table are not all inclusive of those that may be used on a specific project and should be modified and utilized by the Delegated SPM as applicable

<sup>2</sup> Isotopic Thorium/Alpha Spectroscopy, Isotopic Uranium/Alpha Spectroscopy, and Gamma Spectroscopy.

### QAPP Worksheet #31, 32 & 33: Assessments and Corrective Action

Assessment Type	Responsible Party & Organization	Number/Frequency	Estimated Dates	Assessment Deliverable	Deliverable Due Date
Field Sampling Technical Systems Audit (TSA) <sup>1</sup>	Chemist QA/QC Specialist (or designee) and Group Leader or Operations Manager WESTON	As needed, as determined by WESTON Chemist QA/QC Specialist (or designee) and Group Leader or Program Manager WESTON	To be completed near the beginning of field sample collection activities/9/8/2019	TSA Memorandum and Checklist	48 to 72 hours following assessment
Laboratory TSA <sup>2</sup>	Laboratory QA Manager Velinda Herbert	NAREL, and certified subcontract laboratories are routinely audited by accrediting authorities.	Every Year	Written Report	14 Days
Project-Specific PT/PE Samples	Chemist QA/QC Specialist (or designee) WESTON	Varies; as determined by WESTON Chemist QA/QC Specialist (or designee)	Not Required	PT/PE Deficiency Report (memo/e-mail to file)	Not Required
Data Validation	Chemist QA/QC Specialist or CHP/Data Validator WESTON	Each data package for which data validation was requested; varies by site	Within 42 days from the sampling date	Data Validation Report	Varies by site
Management Review	Group Leader and/or Operations Manager WESTON	Varies; as determined by WESTON Program Manager	Varies; as determined by WESTON Program Manager	Quality Management Report (memo/e-mail to file)	1-2 weeks following assessment

<sup>1</sup> Field sampling TSAs may include, but are not limited to the following: sample collection records; sample handling, preservation, packaging, shipping, and custody records; equipment operation, maintenance, and calibration records.

<sup>2</sup> Laboratory TSAs may include, but are not limited to the following: sample log-in, identification, storage, tracking, and custody procedures; sample and standards preparation procedures; availability of analytical instruments; analytical instrument operation, maintenance, and calibration records; laboratory security procedures; qualifications of analysts; case file organization and data handling procedures.

### Worksheet 31, 32 & 33 — Assessments and Corrective Action (Concluded)

Assessment Type	Responsibility for Responding to Assessment Findings	Assessment Response Documentation	Timeframe for Response	Responsibility for Implementing Corrective Action	Responsible for Monitoring Corrective Action Implementation
Field Sampling Technical Systems Audit (TSA) <sup>1</sup>	SPM, WESTON	Findings of field audit.	24 hours of receipt of audit report	Operations Manager, WESTON	SPM or Operations Manager, WESTON
Laboratory TSA <sup>2</sup>	NAREL Analytical Service Coordinator, Tonya Hudson NAREL QA Manager, Velinda Herbert Chemist QA/QC Specialist (or designee), WESTON	Written response to Weston Chemist QA/QC Specialist  EPA Region 2 to address deficiencies	1 week of receipt of request from EPA Region 2 (or START V on behalf of EPA)	Laboratory Manager, NAREL	Quality Manager (or designee) and/or Chemist, WESTON
Project-Specific PT/PE Samples	No Applicable	No Applicable	No Applicable	No Applicable	No Applicable
Data Validation	Non-CLP data: Chemist QA/QC Specialist (or designee), WESTON	Validation Report	Within 48 hours of receipt of validation inquiry	Laboratory QA Manager and/or Chemist	Chemist, WESTON
Management Review	Program Manager, WESTON	Quality Management Response	48 hours of receipt of Quality Management report	Program Manager, WESTON	Chemist QA/QC Specialist (or designee) and Program Manager, WESTON

<sup>1</sup> Field sampling TSAs may include, but are not limited to the following: sample collection records; sample handling, preservation, packaging, shipping, and custody records; equipment operation, maintenance, and calibration records.

<sup>2</sup> Laboratory TSAs may include, but are not limited to the following: sample log-in, identification, storage, tracking, and custody procedures; sample and standards preparation procedures; availability of analytical instruments; analytical instrument operation, maintenance, and calibration records; laboratory security procedures; qualifications of analysts; case file organization and data handling procedures.

### QAPP Worksheet #34: Data Verification and Validation Inputs

Item	Description	Verification (completeness)	Validation (conformance to specifications)
<b>Planning Documents/Records</b>			
1	Approved QAPP	X	
2	Contract	X	
3	Field SOPs	X	
4	Laboratory SOPs	X	
5	Laboratory QA Manual	X	
6	Laboratory Certifications	X	
<b>Field Records</b>			
7	Field Logbooks	X	X
8	Equipment Calibration Records	X	X
9	Chain of Custody Forms	X	X
10	Sampling Diagrams/Surveys	X	X
11	Drilling Logs	X	X
12	Geophysics Reports	X	X
13	Relevant Correspondence	X	X
14	Change Orders/Deviations	X	X
15	Field Audit Reports	X	X
16	Field Corrective Action Reports	X	X
17	Sample Location Verification (Worksheet 18)	X	X
<b>Analytical Data Package and Other Laboratory Deliverables</b>			
18	Cover Sheet (laboratory identifying information)	X	X
19	Case Narrative	X	X
20	Internal Laboratory Chain of Custody	X	X
21	Sample Receipt Records	X	X
22	Sample Chronology (i.e. dates and times of receipt, preparation, & analysis)	X	X
23	Communication Records	X	X
24	Project-specific PT Sample Results	NA	NA
25	RL/MDL Establishment and Verification	X	X
26	Standards Traceability	NA	NA
27	Instrument Calibration Records	X	X
28	Definition of Laboratory Qualifiers	X	X
29	Results Reporting Forms	X	X
30	QC Sample Results	X	X
31	Corrective Action Reports	X	X
32	Raw Data	X	X
33	Electronic Data Deliverable	X	X

### QAPP Worksheet #35: Data Verification Procedures

Records Reviewed	Required Documents	Process Description	Responsible Person, Organization
Site-specific QAPP	Contract QAPP, Work Scope in TD	Verify sampling and analytical methods specified in site-specific QAPP are correct and all contract QAPP protocols are followed and required QC samples will be collected in the correct bottles and properly preserved.	Bernard Nwosu WESTON Operations Manager Smita Sumbaly, WESTON Chemist QA/QC Specialist
Field Logs and SOPs	Contract and site-specific QAPP, SOPs	Ensure that all field sampling SOPs specified in site-specific QAPP were followed.	WESTON SPM and Data Validation Personnel
Analytical SOPs	Analytical Method and Contract QAPP	Ensure that laboratory analytical SOPs comply with the published method.	Laboratory QA Manager: Velinda Herbert WESTON Chemist QA/QC Specialist /Smita Sumbaly
Laboratory QA Manual	EPA Guidance Documents	Verify that best practices specified in EPA Guidance Documents are incorporated into the Laboratory QA Manual.	Laboratory QA Manager: Velinda Herbert
Laboratory Certifications	Generic and site-specific QAPP	Ensure that laboratory performing analytical sample analyses has current State, National Environmental Laboratory Accreditation Program, National Voluntary Laboratory Accreditation Program, or American Industrial Hygiene Association certifications as required by the project.	Laboratory QA Manager: Velinda Herbert
Laboratory Deliverables	Chain of Custody	Chain-of-custody forms will be verified against the sample cooler they represent. Sample Acceptance Checklist is completed. NAREL staff supervisor utilizes the analyses request information and the external COC to review the accuracy and completeness of LIMS log-in entries, as reflected on the LIMS Sample Receipt Form Details can be found in Laboratory Quality Management Plan, SOP G-25	Laboratory QA Manager: Velinda Herbert EPA RSCC/SMO coordinator

### QAPP Worksheet #35: Data Verification Procedures (Concluded)

Records Reviewed	Required Documents	Process Description	Responsible Person, Organization
Laboratory Deliverables	Chain of Custody	Chain-of-custody forms will be verified against the sample cooler they represent. Sample Acceptance Checklist is completed. The non-CLP labs, sample custodian utilizes the analyses request information and the external COC to review the accuracy and completeness of LIMS log-in entries, as reflected on the LIMS Sample Receipt Form Details can be found in Laboratory Quality Management Plan.	Laboratory sample custodian , Laboratory QA Manager: Velinda Herbert
Laboratory QA Manual	Analytical data package/ Final Report	The procedures for data review : 1- Data reduction/review by Primary Analyst. 2- Review complete data package (raw data) by independent Peer Reviewer 3- The Branch Chief/Section Chief reviews the project documentation for completeness followed by a QA review by the QAO 4- Final review by Branch Chief/Section Chief prior to release, this review is to ensure completeness and general compliance with the objectives of the project. This final review typically does not include a review of raw data. Details can be found in Laboratory Quality Management Plan and SOP G-26.	Primary Analyst, Peer Reviewer, Sample Project Coordinator, Quality Assurance Officer, Section Chief/ Branch Chief. NAREL – EPA laboratory
Field Logbook, Field Sheets, Sample Diagrams/ Surveys	site-specific QAPP	Verify that records are present and complete for each day of field activities. Verify that all planned samples including field QC samples were collected and that sample collection locations are documented. Verify that meteorological data were provided for each day of field activities. Verify that changes/exceptions are documented and were reported in accordance with requirements. Verify that any required field monitoring was performed and results are documented.	WESTON SPM and Operations Manager
Field Equipment Calibration Records	site-specific QAPP, SOPs, field logbook	Ensure that all field analytical instrumentation SOPs for equipment calibration were followed.	WESTON SPM and Operations Manager
Relevant reports and correspondence	site-specific QAPP	Verify that reports are present and complete for each day of field activities. Verify that correspondence is documented and was reported in accordance with requirements.	WESTON SPM and Operations Manager
Audit Reports, Corrective Action Reports	site-specific QAPP	Verify that all planned audits were conducted. Examine audit reports. For any deficiencies noted, verify that corrective action was implemented according to plan.	Smita Sumbaly, WESTON Chemist QA/QC Specialist Laboratory PM, NAREL

### QAPP Worksheet #36: Data Validation Procedures

The following information is project-specific and will be identified in the site-specific or QAPP.

**Data Validator:** Weston, CHP/Data validator

Analytical Group/ Method	Data Deliverable Requirements	Analytical Specifications	MPC	Percent of Data Packages to be Validated	Percent of Raw Data Reviewed	Percent of Results to be Recalculated	Validation Procedure	Validation Code	Electronic Validation Program/ Version
Soil	SEDD Stage IIa/IIb	NAREL ACT-02F-TH	Worksheets 12, 24, 28	100%	100%	100%	Sampling Method, Lab SOP, Calculations, QC Criteria	Validated Manually (VM)	Excel spreadsheet
Soil	SEDD Stage IIa/IIb	NAREL ACT-02F-U	Worksheets 12, 24, 28	100%	100%	100%	Sampling Method, Lab SOP, Calculations, QC Criteria	Validated Manually (VM)	Excel spreadsheet
Soil	SEDD Stage IIa/IIb	NAREL GAM-01-RA	Worksheets 12, 24, 28	100%	100%	100%	Sampling Method, Lab SOP, Calculations, QC Criteria	Validated Manually (VM)	Excel spreadsheet

### **QAPP Worksheet #37: Usability Assessment**

Data usability assessments (DUA) will be performed as directed by EPA. This worksheet documents procedures that will be used to perform the DUA. The DUA is performed at the conclusion of data collection activities using the outputs from data verification and data validation (i.e., data of known and documented quality). It is the data interpretation phase, which involves a qualitative and quantitative evaluation of environmental data to determine whether the Site data are of the right type, quality, and quantity to support the decisions that need to be made. It involves a retrospective evaluation of the systematic planning process, and involves participation by key members of the project team. The DUA evaluates whether underlying assumptions used during systematic planning are supported, sources of uncertainty have been accounted for and are acceptable, data are representative of the population of interest, and the results can be used as intended, with the acceptable level of confidence.

Data, whether generated in the field or by the laboratory, are tabulated and reviewed for PARCCS by the SPM for field data or the data validator for laboratory data. The review of the PARCC Data Quality Indicators (DQI) will compare with the Data Quality Objectives (DQO) detailed in the site-specific QAPP, the analytical methods used and impact of any qualitative and quantitative trends will be examined to determine if bias exists. A hard copy of field data is maintained in a designated field or site logbook. Laboratory data packages are validated, and final data reports are generated. All documents and logbooks are assigned unique and specific control numbers to allow tracking and management.

Where applicable, the following documents will be followed to evaluate data for fitness in decision making: EPA QA/G-4, Guidance on Systematic Planning using the Data Quality Objectives Process, EPA/240/B-06/001, February 2006, and EPA QA/G-9R, Guidance for Data Quality Assessment, A reviewer's Guide EPA/240/B-06/002, February 2006.

Personnel (organization and position/title) responsible for participating in the data usability assessment may include, but not be limited to:

- START V Operations Manager;
- START V Quality Manager (or designee);
- START V Risk Assessor;
- START V SPM;
- START V Chemist QA/QC Specialist;
- START V Statistician.

Based on project-specific oversight responsibilities and analytical scopes, this DUA worksheet outlines the approach that will be taken as the analytical scope expands on a project-specific basis.

The following general steps will be followed to assure that the data usability assessment evaluates whether underlying assumptions used during systematic planning are supported, sources of uncertainty have been accounted for and are acceptable, data are representative of the population of interest, and the results can be used as intended, with the acceptable level of confidence:

### **QAPP Worksheet #37: Usability Assessment (Concluded)**

**Step 1 – Review the project’s objectives and sampling design:** This includes reviewing the DQOs and MPC to make sure they are still applicable. The sampling design will be consistent with stated DQOs.

**Step 2 – Review the data verification and data validation outputs:** Graphs, maps, and tables can be prepared to summarize the data. Deviations from activities planned in the Project QAPP should be considered, including samples not collected (potential data gaps), holding time exceedances, damaged samples, impact of non-compliant PE sample results, and SOP deviations. The implications of unacceptable QC sample results will be assessed.

**Step 3 – Verify the assumptions of the selected statistical method:** The underlying assumptions for the selected statistical methods (if specified in the QAPP) will be verified for validity. Common assumptions include the distributional form of the data, independence of the data, dispersion characteristics, homogeneity, etc. Depending on the robustness of the statistical method, minor deviations from assumptions usually are not critical to statistical analysis and data interpretation. If serious deviations from assumptions are discovered, then another statistical method may be selected.

**Step 4 - Implement the statistical method:** If specified in the site-specific QAPP, statistical procedures will be implemented for analyzing the data and reviewing underlying assumptions. For a decision project that involves hypothesis testing (e.g., “concentrations of lead in groundwater are below the action level”) the consequences of selecting the incorrect alternative will be considered; for estimation projects (e.g., establishing a boundary for surface soil contamination), the tolerance for uncertainty in measurements will be considered.

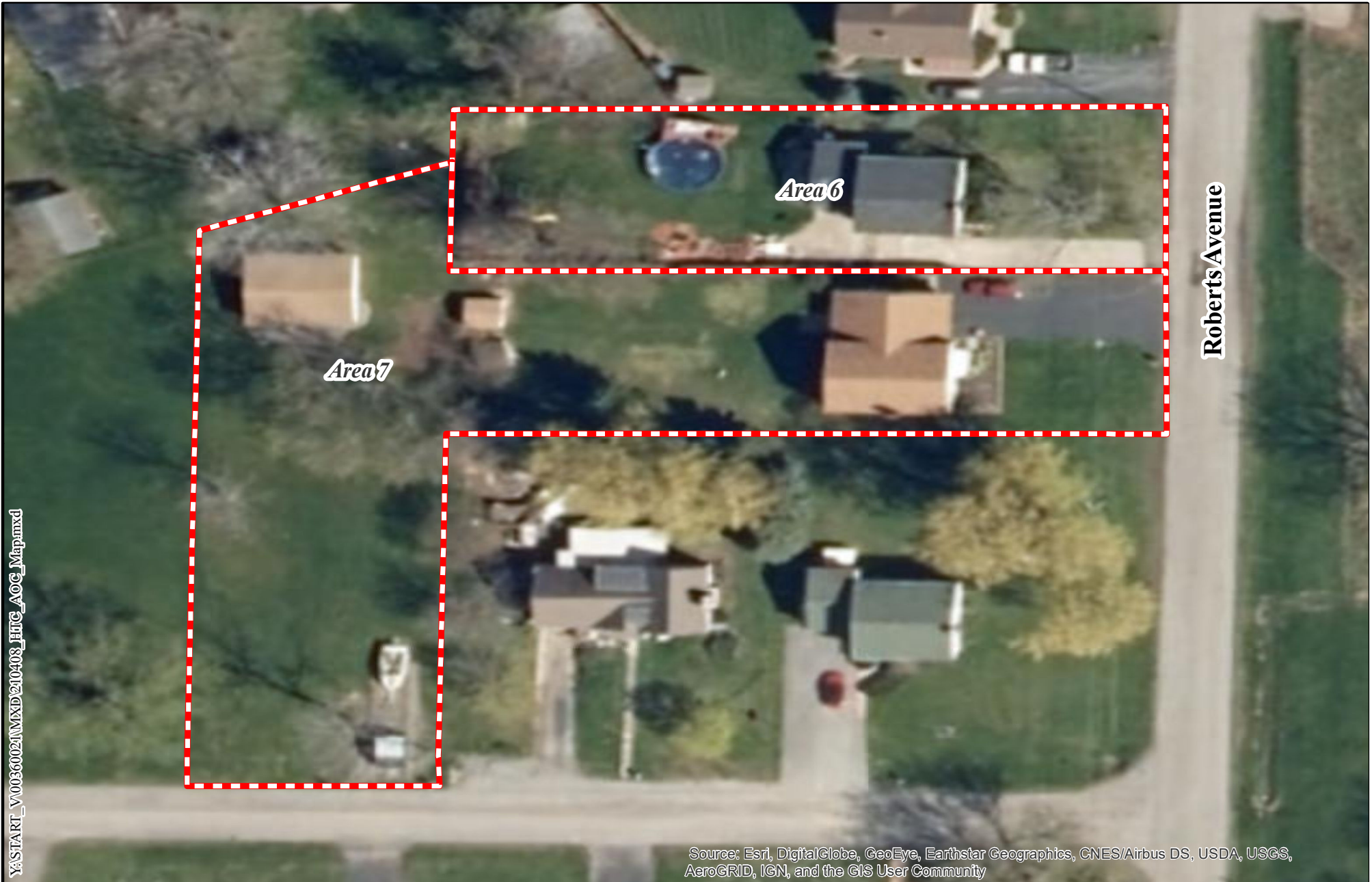
#### **Step 5 – Document data usability and draw conclusions:**

The DUA considered the final step in the data evaluation process. All data will be assessed for usability regardless of data evaluation/validation process implementation. Data usability goes beyond validation in that it evaluates the achievement of the DQOs based on the comparison of the project DQIs and site-specific QAPP with the obtained results. The results of the DUA, and particularly any changes to the DQOs necessitated by the data not meeting usability criteria, will be communicated in accordance with Worksheet 6.

The usability of the data as intended will be determined. Achievable DQOs, based on comparison with the Site DQIs, will be discussed. The performance of the sampling design will be assessed and limitations of the data use identified. The conceptual site model will be updated and conclusions documented. A DUA report (in the form of text/or table) will be prepared or a data usability summary will be included in the final report.

## **ATTACHMENT A**

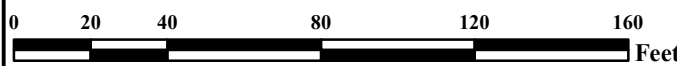
Figure 1: Site Location Map



Y:\START\_V\00360021\MXD\210403\_HTC\_AOC\_Map.mxd

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

**Legend**  
 Area of Concern




**Weston Solutions, Inc.**  
**Federal East Division**

In Association With

Eco-Risk; Avatar Environmental, LLC;  
 Pro-West & Associates, Inc.;  
 On-Site Environmental, Inc.;  
 and Sovereign Consulting, Inc.

Figure 1: Area of Concern Map	
HOLY TRINITY CEMETERY LEWISTON, NEW YORK	
U.S. ENVIRONMENTAL PROTECTION AGENCY SUPERFUND TECHNICAL ASSESSMENT & RESPONSE TEAM V CONTRACT # 68HE0319D0004	
GIS ANALYST:	M. LANG
EPA OSC:	P. LISICHENKO
START V SPM:	T. O'DONNELL
FILENAME:	210528 HTC AOC_Map.mxd

DATE MODIFIED: 4/8/2021

## **ATTACHMENT B**

### **Sampling SOPs**

ERT/SERAS SOP # 2001 – *General Field Sampling Guidelines*

ERT/SERAS SOP # 2012 – *Soil Sampling*



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## GENERAL FIELD SAMPLING GUIDELINES

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### GENERAL FIELD SAMPLING GUIDELINES

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## GENERAL FIELD SAMPLING GUIDELINES

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### 1.0 OBJECTIVE

The objective of this standard operating procedure (SOP) is to describe the general field sampling techniques and guidelines that will assist in planning, choosing sampling strategies and sampling locations, and frequency of Quality Control (QC) samples for proper assessment of site characteristics. The ultimate goal is to ensure data quality during field collection activities.

A Quality Assurance Project Plan (QAPP) in Uniform Federal Policy (UFP) format describing the project objectives must be prepared prior to deploying for a sampling event. The sampler needs to ensure the methods used are adequate to satisfy the data quality objectives (DQOs).

The procedures in this SOP may be varied or changed as required, dependent on site conditions, equipment limitations or other procedural limitations. In all instances, the procedures employed must be documented on a Field Change Form and attached to the QAPP. These changes must be documented in the final deliverable.

### 2.0 APPLICABILITY

This SOP applies to the collection of aqueous and non-aqueous samples for subsequent laboratory analysis to determine the presence, type, and extent of contamination at a site.

### 3.0 DESCRIPTION

Representative sampling ensures that a sample or a group of samples accurately reflect the target population from which the sample(s) are intended to draw conclusions about. Depending on the contaminant of concern and matrix, several environmental and logistical variables may contribute to uncertainty in sampling design, which may affect the representativeness of the samples and subsequent measurements. Environmental variability can occur due to non-uniform distribution of the pollutant due to topographic, meteorological and hydrogeological factors, changes in species, and dispersion of contaminants and flow rates. Logistical variables including restricted or limited access to areas for sampling due to health and safety concerns, physical obstructions, or inability to obtain access agreements may affect the spatial representativeness of the sampling design and/or preclude samples from being collected in areas of interest.

Determining the sampling approach depends on what is known about the site from prior sampling (if any) and the site history, variation of the contaminant concentrations throughout a site, potential migration pathways, and human and environmental receptors. The objectives of an investigation determine the appropriate sampling design.

The frequency of sampling and the specific sample locations that are required must be defined in the site-specific QAPP.

#### 3.1 Planning Stage

The objectives of an investigation are established and documented in the site-specific QAPP. The technical approach including the media/matrix to be sampled, sampling equipment to be used, sampling design and rationale, and SOPs or descriptions of the procedure to be implemented are included in the QAPP. Refer to the matrix-specific SOPs for sampling techniques which include the equipment required for sampling.

During the planning stage, the DQOs will be determined. In turn, the project's DQOs will determine the need for screening data or definitive data. Screening data supports an intermediate or preliminary decision but eventually is supported by definitive data before the project is complete (i.e., placement



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## GENERAL FIELD SAMPLING GUIDELINES

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of monitor wells, estimation of extent of contamination). Definitive data is suitable for final decision making, has defined precision and accuracy requirements and is legally defensible (i.e., risk assessments, site closures).

### 3.2. Sampling Design

A sample design specifies the number of samples to be collected for each matrix of concern, the measurements which will be conducted on those samples, where the samples will be collected (downstream of the contaminant release, along a grid, etc.) and how the samples will be collected (discrete or composite samples, seasonally, etc.). The DQOs for a Site assist in selecting the appropriate sampling design for the population of concern (e.g., lead concentrations in residential soil, contaminant uptake in plants, polychlorinated biphenyl [PCB] levels in a specific reach of a river). Other factors may include logistical, measurement and budgetary constraints, such as accessibility to the sampling area, analytical instrument sensitivity or manpower availability. EPA QA/G-5S, *Guidance on Choosing a Sampling Design for Environmental Data Collection*, provides detailed guidance on the selection of a representative sampling design.

There are two main categories of environmental sampling designs:

1. Judgmental, also known as biased or targeted sampling; and
2. Probability-based sampling, which includes, but is not limited to, simple random, systematic, ranked set, stratified and cluster sampling.

Judgmental sampling is based on expert/technical knowledge of the site, known contaminant pathways and the chemical/physical processes associated with the contaminants of concern (COCs). It can be less expensive than probability-based sampling as it is typically quicker to implement. It is often used to target sampling in areas where there have been known chemical spills or visible staining of the matrix of concern. Because it is based on professional judgment, the reliability and precision of the results cannot be quantified using statistical assessments. The interpretation of the sampling results is dependent on personal interpretation.

Although probabilistic sampling is often more costly in time and implementation, this type of design allows for the assessment of the uncertainty associated with the sampling results and provides reproducible results, if performed accurately. Probability-based sampling includes a random/unbiased component for locating samples. Inferential statistics can be used to extend the measured results of the sampling efforts to the larger population of concern and statistical limits can be computed assessing the variability of the measurements. Probabilistic sampling is used when DQOs include the need to obtain the mean or median concentration across an area of concern, establish variability of the COC(s), perform trend analyses, determine the probability of exceeding an actionable level, locate hot spot(s) within a designated area, compare reference and on-site COCs, and establish background levels of COCs. There are many more applications of probabilistic-sampling. Simple random, systematic and stratified random sampling are the most commonly applied sampling designs in assessing environmental sites.

#### 3.2.1 Judgmental Sampling

Judgmental sampling is the subjective selection of sampling locations based on the professional judgment of the field team. This method is useful to locate and to identify potential sources of contamination when there is reliable historical and physical knowledge about a relatively small feature or condition. It may not be representative of the full site and is used to document worst case scenarios. For example, groundwater sampling points



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are typically chosen based on professional judgment, whether permanently installed wells or temporary well points. Judgmental sampling may also be implemented at a site when there are schedule and budget limitations, or to determine if there are contaminant “hotspots” that require further investigation using an extensive probability-based sampling design. For example, judgmental sampling may be used to identify multiple areas of contaminated soil, and a subsequent probability-based sampling design can be used to fully delineate the extent of the contaminated soil in each area within a specified level of uncertainty.

### 3.2.2 Simple Random Sampling

In simple random sampling, sample locations are selected randomly. For example, random pairs of coordinates could be selected from an area where soil sampling is planned. The simple random sampling approach is applied when there are many sample locations and the concentrations are assumed to be homogeneous across a site with respect to the parameter(s) that are going to be analyzed or monitored for. Simple random sampling can also be used to select an initial sample location in a systematic and stratified sampling design.

### 3.2.3 Systematic Sampling

Systematic grid sampling involves the collection of samples at fixed intervals when the contamination is assumed to be randomly distributed. A random point is chosen as the origin for the placement of the grid. A grid is constructed over a site and samples are collected from the nodes (where the grid lines intersect). Depending on the number of samples that are required to be collected, the distance between the sampling locations can be adjusted. The representativeness of the sampling may be improved by shortening the distance between sample locations.

Systematic random sampling is used for estimating contaminant concentrations within grid cells. Instead of sampling at each node, a random location is chosen within each grid cell. The systematic grid and random sampling approaches are useful for delineating the extent of contamination, documenting the attainment of clean-up goals, and evaluating and determining treatment and disposal options.

Transect sampling involves one or more transect lines established across the site. Samples are collected at systematic intervals along the transect lines. The number of samples to be collected and the length of the transect line determines the spacing between the sampling points. This type of sampling design is useful for delineating the extent of contamination at a particular site, for documenting the attainment of clean-up goals, and for evaluating and determining treatment and disposal options.

### 3.2.4 Stratified Sampling

Stratified sampling involves separating a site with heterogeneous conditions into multiple homogeneous strata. It is useful when a heterogeneous population or area can be broken down into regions with less variability within the boundaries of a stratum than between the strata. Professional judgement, historical information, site observations, exposure to ecological and human receptors, soil type, fate and transport mechanisms, and other site-specific factors can be used to separate a sampling area into multiple strata. Additionally, strata can be defined based on the decisions that will be made. Sampling locations can be



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selected from each stratum using professional judgment, random sampling, or systematic sampling. Using a systematic sampling design within each stratum, with varying sample densities between different strata, ensures that areas of the site thought to have higher variability in contaminant concentrations and/or thought to be within the boundaries of uncertainty surrounding decision levels are sampled at a higher spatial resolution. This method still maintains a representative and unbiased sample design within each stratum.

### 3.3 Sampling Techniques

Sampling is the selection of a representative portion of a larger population or body (i.e. target population). The primary objective of all sampling activities is to characterize a site accurately in a way that the impact on human health and the environment can be evaluated appropriately.

#### 3.3.1 Sample Collection Techniques

Sample collection techniques may be either grab or composite. A grab sample is a discrete aliquot representative of a specific location at a given time and collected all at once from one location. The representativeness of such samples is defined by the nature of the materials that are sampled. Samples collected for volatile organic compounds (VOCs) are always grab samples and are never homogenized. Composite samples are non-discrete samples composed of more than one specific aliquot collected at selected sampling locations. Composite samples must be homogenized by mixing prior to putting the sample into containers. Composite samples can, in certain instances, be used as an alternative to analyzing a number of individual grab samples and calculating an average value. Incremental sampling conducted over a grid is a special case of composite sampling and is detailed in U.S. EPA Environmental Response Team (ERT) SOP, *Incremental Soil Sampling*. Choice of collecting discrete or composite samples is based on project's DQOs.

#### 3.3.2 Homogenization

Mixing of soil and sediment samples is critical to obtain a representative sample. An adequate volume/weight of sample is collected and placed in a stainless steel or Teflon® container, and is thoroughly mixed using a spatula or spoon made of an inert material. Once the sample is thoroughly mixed the sample is placed into sample containers specific for an analysis. Avoid the use of equipment made of plastic or polyvinyl chloride (PVC) when sampling for organic compounds when the reporting limit (RL) is in the parts per billion (ppb) or parts per trillion (ppt) ranges. Refer to ERT SOP, *Soil Sampling*, for more details on homogenization.

#### 3.3.3 Filtration

In-line filters are used specifically for collecting groundwater samples for dissolved metals analysis and for filtering large volumes of turbid groundwater. Groundwater samples collected for VOCs are typically not filtered due to potential VOC losses. Filtering groundwater is performed to remove silt particulates from samples to prevent interference with the laboratory analysis. The filters used in groundwater sampling are either cartridge type filters inserted into a reusable housing, or are self-contained and disposable. Filter chambers are usually made of polypropylene housing an inert filtering material that removes particles larger than 0.45 micrometers (µm). Refer to ERT SOP, *Groundwater Well Sampling* and ERT SOP, *Surface Water Sampling*, for more details on filtration techniques.



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### 3.4 Quality Assurance /Quality Control Samples

QA/QC samples provide an evaluation of both the laboratory's and the field sampling team's performance. Including QA/QC samples in a sampling design allows for identifying and measuring sources of error potentially introduced from the time of sample collection through analysis. The most common QA/QC samples collected in the field are collocated field duplicates, field replicates, equipment blanks and field blanks. Trip blanks are typically added for each matrix in each cooler used to ship VOC samples and are prepared prior to going into the field preferably by the laboratory that will be performing the analyses. Extra volume/mass is collected for a matrix spike/matrix spike duplicate (MS/MSD) at a frequency of 5 percent (%; one in 20 samples). Spiking is performed in the laboratory. For additional information or other QA/QC samples pertinent to sample analysis, refer to ERT SOP, *Quality Assurance/Quality Control Samples*.

Collocated field duplicates may be collected based on site objectives and used to measure variability and precision associated with the sampling process including sample heterogeneity, sampling methodology, and analytical procedures. Field replicates are field samples obtained from one location, homogenized, and divided into separate containers. This is useful for determining whether the sample has been homogenized properly. Equipment blanks (also known as rinsate blanks) are typically collected at a rate of one per day. The equipment blank is used to evaluate the relative cleanliness and the decontamination methods of non-dedicated equipment. Refer to ERT SOP, *Sampling Equipment Decontamination*, for more details regarding decontaminating non-dedicated equipment.

### 3.5 Sample Containers, Preservation, Storage and Holding Times

The amount of sample to be collected, the proper sample container type (i.e., glass, plastic), chemical preservation, and storage requirements are dependent on the matrix sampled and the analyses to be conducted. This information is provided in ERT SOP, *Sample Storage, Preservation, and Handling*. Field personnel need to be cognizant of any short holding times that warrant immediate shipment/transfer to the laboratory.

### 3.6 Documentation

Field conditions and site activities must be documented. Scribe will be used to document sample information and generate chain of custody records. Other field measurements not typically entered into Scribe will be documented in a site-specific logbook or in a personal logbook. All sample documentation will be maintained in accordance with ERT SOP, *Sample Documentation* and ERT SOP, *Chain of Custody Procedures*.

## 4.0 RESPONSIBILITIES

### 4.1 ERT Work Assignment Manager

The ERT WAM is responsible for providing technical expertise and technical direction to the contractor, preparing task orders/work assignments, reviewing deliverables, interacting with the Regional customers and monitoring the financial and administrative management of the project.



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### 4.2 ERT Quality Control Coordinator

The ERT Quality Coordinator provides quality assurance oversight for all projects and implements/maintains the ERT Quality Assurance Program.

### 4.3 ERT Contractor Task Leaders

Task Leaders (TLs) are responsible for the overall management of the project. Task Leader responsibilities include ensuring that field personnel are well informed of the sampling requirements for a specific project and that SOP and QA/QC procedures stated in the site-specific QAPP are adhered to, issuing a Field Change Form that documents any changes to sampling activities after the QAPP has been approved and maintaining sample documentation.

### 4.4 ERT Contractor Field Personnel

Field personnel are responsible for reading the QAPP prior to site activities and performing sample collection activities as written. They are responsible for notifying the TL of deviations from sample collection protocols which occurred during the execution of sampling activities. Field staff will collect samples and prepare documentation in accordance with ERT SOP, *Sample Documentation*. In addition, field personnel are responsible for reading and conforming to the approved site-specific Health and Safety Plan (HASP).

### 4.5 ERT Contractor QA/QC Officer

The contractor's QA/QC Officer is responsible for reviewing this SOP and ensuring that the information in this SOP is updated on a timely basis. Compliance to this SOP may be monitored by either conducting a field audit or reviewing deliverables prepared by the contractor's TL.

### 4.6 ERT Contractor Health and Safety Officer

Based on OSHA requirements, a site-specific health and safety plan (HASP) must be prepared for response operations under the Hazardous Waste Operations and Emergency Response (HAZWOPER) standard, [29 CFR 1910.120](https://www.ecfr.gov/current/title-29/chapter-I/subchapter-H/part-1910/section-1910.120). Field personnel working for EPA's ERT should consult the Emergency Responder Health and Safety Manual currently located at <https://response.epa.gov/HealthSafetyManual/manual-index.htm> for the development of the HASP, required personal protective equipment (PPE) and respiratory protection.

The contractor's Health and Safety Officer (HSO) is responsible for ensuring that a HASP has been written and approved prior to field activities. Additionally, the contractor's HSO is responsible for ensuring that the contractor's site personnel H&S training and that their medical monitoring is current.

## 5.0 REFERENCES

U.S. EPA. 2006. Guidance on Systematic Planning using the Data Quality Objectives Process (QA/G-4), EPA/240/B-06/001, February 2006.

U.S. EPA. 2002. Guidance on Choosing a Sampling Design for Environmental Data Collection (QA/G-5S), EPA/240/R-02/005, December 2002.



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### 6.0 APPENDICES

This section is not applicable to this SOP.



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### 1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to describe procedures for the collection of representative surface soil samples. Sampling depths are assumed to be those that can be reached without the use of a drill rig, direct-push technology, or other mechanized equipment (except for a back-hoe). Sample depths typically extend up to 1-foot below ground surface. Analysis of soil samples may define the extent of contamination, determine whether concentrations of specific contaminants exceed established action levels, or if the concentrations of contaminants present a risk to public health, welfare, or the environment.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations, or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with a final report.

Mention of trade names or commercial products does not constitute United States Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

### 2.0 METHOD SUMMARY

Surface soil samples can be used to investigate contaminants that are persistent in the near surface environment. Contaminants that are detected in the near surface environment may extend to considerable depths, may migrate to the groundwater, surface water, the atmosphere, or may enter biological systems.

Soil samples may be collected using a variety of methods and equipment depending on the depth of the desired sample, the type of sample required (discrete or composite), and the soil type. Near-surface soils may be easily sampled using a spade, trowel, and/or scoop. Sampling at greater depths may be performed using a hand auger, continuous-flight auger, trier, split-spoon sampler, or, if required, a backhoe.

### 3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Samples must be cooled and maintained at 4°C and protected from sunlight immediately upon collection to minimize any potential reaction. The amount of sample to be collected, proper sample container type and handling requirements are discussed in the Scientific, Engineering, Response Analytical Services (SERAS) SOP #2003, *Sample Storage, Preservation and Handling*.

### 4.0 INTERFERENCES AND POTENTIAL PROBLEMS

There are two primary problems associated with soil sampling: 1) cross contamination of samples, and 2) improper sample collection. Cross contamination problems can be eliminated or minimized through the use of dedicated sampling equipment. If this is not possible or practical, decontamination of sampling equipment is necessary. The guidelines for preventing, minimizing and limiting cross contamination of samples are discussed in the Environmental Response Team (ERT)/SERAS SOP #2006, *Sampling Equipment Decontamination*. Improper sample collection procedures can disturb the sample matrix, resulting in volatilization of contaminants, compaction of the sample, or inadequate homogenization of the samples (when required), resulting in variable, non-representative results.

### 5.0 EQUIPMENT/APPARATUS



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Soil sampling equipment includes the following:

- Site maps/plot plan
- Safety equipment, as specified in the site-specific Health and Safety Plan (HASP)
- Traditional survey equipment or global positioning system (GPS)
- Tape measure
- Survey stakes or flags
- Camera and image collection media
- Stainless steel, plastic\*, or other appropriate homogenization bucket, bowl or pan
- Appropriate size sample containers
- Ziplock plastic bags
- Site logbook
- Labels
- Chain of Custody records and custody seals
- Field data sheets and sample labels
- Cooler(s)
- Ice
- Vermiculite
- Decontamination supplies/equipment
- Plastic sheeting
- Spade or shovel
- Spatula(s)
- Scoop(s)
- Plastic\* or stainless steel spoons
- Trowel(s)
- Continuous flight (screw) auger
- Bucket auger
- Post hole auger
- Extension rods
- T-handle
- Sampling trier
- Thin wall tube sampler
- Split spoon sampler
- Soil core sampler
  - Tubes, points, drive head, drop hammer, puller jack and grip
- Photoionization detector (PID), Flame ionization detector (FID) and/or Respirable Aerosol Monitor (RAM)
- Backhoe (as required)
- En Core® samplers

\* Not used when sampling for semivolatile compounds.

### 6.0 REAGENTS

Decontamination solutions are specified in ERT/SERAS SOP #2006, *Sampling Equipment Decontamination*, and the site specific work plan.



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### 7.0 PROCEDURES

#### 7.1 Preparation

1. Determine the extent of the sampling effort, the analytes to be determined, the sampling methods to be employed, and the types and amounts of equipment and supplies required to accomplish the assignment.
2. Obtain the necessary sampling and air monitoring equipment.
3. Prepare schedules and coordinate with staff, client, and regulatory agencies, as appropriate.
4. Perform a general site reconnaissance survey prior to site entry in accordance with the site specific HASP.
5. Use stakes or flags to identify and mark all sampling locations. Specific site factors, including extent and nature of contamination, should be considered when selecting sample locations. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions. All staked locations should be utility-cleared prior to soil sampling; utility clearances must be confirmed before beginning intrusive work.
6. Pre-clean and decontaminate equipment in accordance with the site specific work plan, and ensure that it is in working order.

#### 7.2 Sample Collection

##### 7.2.1 Surface Soil Samples

The collection of samples from near-surface soil can be accomplished with tools such as spades, shovels, trowels, and scoops. The over-burden or over-lying surface material is removed to the required depth and a stainless steel or plastic scoop is used to collect the sample. Plastic utensils are not to be used when sampling for semivolatile compounds.

This method can be used in most soil types but is limited to sampling at or near the ground surface. Accurate, representative samples can be collected by this procedure depending on the care and precision demonstrated by the sample team member. A flat, pointed mason trowel to cut a block of the desired soil is helpful when undisturbed profiles are required. Tools plated with chrome or other materials must not be used.

The following procedure is used to collect surface soil samples:

1. If volatile organic compound (VOC) contamination is suspected, use a PID to monitor the sampler's breathing zone during soil sampling activities.
2. Using a pre-cleaned, stainless steel scoop, plastic spoon, or trowel, remove and discard sticks, rocks, vegetation and other debris from the sampling area.
3. Accumulate an adequate volume of soil, based on the type(s) of analyses to be performed, in



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a stainless, plastic or other appropriate container.

4. If volatile organic analysis is to be performed, immediately transfer the sample directly into an appropriate, labeled sample container with a stainless steel spoon, or equivalent, and secure the cap tightly to ensure that the volatile fraction is not compromised. Thoroughly mix the remainder of the soil to obtain a sample that is representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly, or, if composite samples are to be collected, place a sample from another sampling interval or location into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

### 7.2.2 Sampling at Depth with Augers and Thin Wall Tube Samplers

This system consists of an auger, head, a series of extensions, and a "T" handle (Figure 1, Appendix A). The auger is used to bore a hole to a desired sampling depth, and is then withdrawn. The sample may be collected directly from the auger head. If additional sample volume is required, multiple grabs at the same depth are made. If a core sample is to be collected, the auger head is then replaced with a tube auger. The system is then lowered down the borehole, and driven into the soil to the completion depth. The system is withdrawn and the core is collected.

Several types of augers are available; these include bucket or tube type, and continuous flight (screw) or post-hole augers. Bucket or tube type augers are better for direct sample recovery because a large volume of sample can be collected from a discrete area in a short period of time. When continuous flight or post-hole augers are used, the sample can be collected directly from the flights or from the borehole cuttings. The continuous flight or post-hole augers are satisfactory when a composite of the complete soil column is desired, but have limited utility for sample collection as they cannot be used to sample a discrete depth.

The following procedure is used for collecting soil samples with an auger:

1. Attach the auger head to an extension rod and attach the "T" handle.
2. Clear the area to be sampled of surface debris (e.g., twigs, rocks, litter). It may be advisable to remove a thin layer of surface soil for an area approximately six inches in radius around the sampling location.
3. Begin augering, periodically removing and depositing accumulated soils onto a plastic sheet spread near the hole. This prevents the accidental brushing of loose material back down the borehole when removing the auger or adding extension rods. It also facilitates refilling the hole, and avoids possible contamination of the surrounding area.
4. After reaching the desired depth, slowly and carefully remove the auger from the hole. When sampling directly from the auger head, proceed to Step 10.
5. Remove auger tip from the extension rods and replace with a tube sampler. Install the



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proper cutting tip.

6. Carefully lower the tube sampler down the borehole. Gradually force the tube sampler into the soil. Do not scrape the borehole sides. Avoid hammering the rods as the vibrations may cause the boring walls to collapse.
7. Remove the tube sampler and unscrew the extension rods.
8. Remove the cutting tip and the core from the device.
9. Discard the top of the core (approximately 1 inch), as this possibly represents material collected before penetration of the layer of concern. Place the core or a discrete portion of the core into the appropriate labeled sample container using a clean, decontaminated stainless steel spoon. If required, homogenize the sample as described in Step 10.
10. If VOC analysis is to be performed, transfer the sample directly from the auger head into an appropriate, labeled sample container with a stainless steel spoon, or equivalent and secure the cap tightly.
11. If another sample is to be collected in the same hole, but at a greater depth, reattach the auger head to the drill assembly, and follow steps 3 through 11, making sure to decontaminate the auger head and tube sampler between samples.
12. Abandon the hole according to applicable state regulations.

### 7.2.3 Sampling at Depth with a Trier

The system consists of a trier and a "T" handle. The auger is driven into the soil to be sampled and used to extract a core sample from the appropriate depth.

The following procedure is used to collect soil samples with a sampling trier:

1. Insert the trier (Figure 2, Appendix A) into the material to be sampled at a zero degree to forty-five degree ( $0^{\circ}$  to  $45^{\circ}$ ) angle from the soil surface plane. This orientation minimizes the spillage of sample.
2. Rotate the trier once or twice to cut a core of material.
3. Slowly withdraw the trier, making sure that the slot is facing upward.
4. If VOC analyses are required, transfer the sample directly from the trier into an appropriate, labeled sample container with a stainless steel spoon, or equivalent device and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container and mix thoroughly to obtain a sample that is representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; if composite samples are to be collected, place a sample from another sampling interval into the



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homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

### 7.2.4 Sampling at Depth with a Split Spoon (Barrel) Sampler

Split spoon sampling is generally used to collect undisturbed soil cores of 18- or 24- inches in length. A series of consecutive cores may be extracted with a split spoon sampler to give a complete soil column profile, or an auger may be used to drill down to the desired depth for sampling. The split spoon is then driven to its sampling depth through the bottom of the augured hole and the core extracted.

When split spoon sampling is performed to gain geologic information, all work should be performed in accordance with American Society for Testing and Materials (ASTM) D1586-99, "*Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils*".

The following procedures are used for collecting soil samples with a split spoon:

1. Assemble the sampler by aligning both sides of the barrel and then screwing the drive shoe on the bottom and the head piece on top.
2. Place the sampler at a 90 degree (90°) angle to the sample material.
3. Using a well ring, drive the sampler. Do not drive past the bottom of the head piece or compression of the sample will result.
4. Record in the site logbook or on field data sheets the length of the tube used to penetrate the material being sampled, and the number of blows required to obtain the sample.
5. Withdraw the sampler, and open it by unscrewing the bit and head, and then splitting the barrel. The amount of recovery and soil type should be recorded on the boring log. If a split sample is desired, a cleaned, stainless steel knife should be used to divide the tube contents in half, longitudinally. This sampler is typically available in 2- and 3.5-inch diameter tubes. A larger barrel (diameter and/or length) may be necessary to obtain the required sample volume.
6. Without disturbing the core, transfer it to the appropriately labeled sample container(s) and seal tightly. Place the remainder of the sample into a stainless steel, plastic, or appropriate homogenization container, and mix thoroughly to obtain a sample that is representative of the entire sampling interval. Then, either place the sample into the appropriate, labeled containers and secure the caps tightly, or if composite samples are to be collected, place a sample from another sampling interval or location into the homogenization container and mix thoroughly. When compositing is complete, place the sample into the appropriate, labeled containers and secure the caps tightly.
7. Abandon the hole according to applicable state regulations.



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### 7.2.5 Test Pit/Trench Excavation

A backhoe can be used to remove sections of soil when a detailed examination of stratigraphy and soil characteristics is required. The following procedures are used for collecting soil samples from test pits or trenches:

1. Prior to any excavation with a backhoe, it is imperative to ensure that all sampling locations are clear of overhead and buried utilities.
2. Review the site specific HASP and ensure that all safety precautions including appropriate monitoring equipment are installed as required.
3. Using the backhoe, excavate a trench approximately three feet wide and approximately one foot deep below the cleared sampling location. Place excavated soils on plastic sheets. Trenches greater than five feet deep must be sloped or protected by a shoring system, as required by Occupational Safety and Health Administration (OSHA) regulations.
4. A shovel is used to remove a one to two inch layer of soil from the vertical face of the pit where sampling is to be done.
5. Samples are taken using a trowel, scoop, or coring device at the desired intervals. Be sure to scrape the vertical face at the point of sampling to remove any soil that may have fallen from above, and to expose fresh soil for sampling. In many instances, samples can be collected directly from the backhoe bucket.
6. If VOC analyses are required, transfer the sample into an appropriate, labeled sample container with a stainless steel spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into the appropriate, labeled containers and secure the caps tightly.
7. Abandon the pit or excavation according to applicable state regulations.

### 7.2.6 Sampling for VOCs in Soil Using an En Core® Sampler

An En Core® sampler is a single-use device designed to collect and transport samples to the laboratory. The En Core® sampler is made of an inert composite polymer and reduces the open-air handling of soil samples in the field and in the laboratory; thereby, minimizing losses of VOCs.

1. Assemble the coring body, plunger rod and T-handle according to the instructions provided with the En Core® sampler.



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2. Turn the T-handle with the T-up and the coring body down and push the sampler into the soil until the coring body is completely full. Remove the sampler from the soil. Wipe excess soil from the coring body exterior.
3. Cap the coring body while it is still on the T-handle. Push the cap over the flat area of the ridge. Be sure that the cap is seated properly to seal the sampler. Push and cap to lock arm in place.
4. Remove the capped sampler by depressing the locking lever on the T-handle while twisting and pulling the sampler from the T-handle.
5. Attach the label to the coring body cap, place in a plastic zippered bag, seal and put on ice.

Generally, three En Core® samplers are required for each sample location. These samplers are shipped to the laboratory where the cap is removed and the soil samples are preserved with methanol or sodium bisulfate.

### 8.0 CALCULATIONS

This section is not applicable to this SOP.

### 9.0 QUALITY ASSURANCE/QUALITY CONTROL

There are no specific quality assurance (QA) activities that apply to the implementation of these procedures. However, the following general QA procedures apply:

2. All data must be documented in site logbooks or on field data sheets. At a minimum, the following data is recorded:

- Sampler's name and affiliation with project
- Sample number
- Sample location
- Sample depth
- Approximate volume of sample collected
- Type of analyses to be performed
- Sample description
- Date and time of sample collection
- Weather conditions at time of sampling
- Method of sample collection
- Sketch of sample location

2. All instrumentation must be operated in accordance with applicable SOPs and/or the manufacturer's operating instructions, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and must be documented.
3. The types of quality control (QC) samples to be collected in the field shall be documented in the site-specific Work Plan.



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### 10.0 DATA VALIDATION

This section is not applicable to this SOP.

### 11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA and corporate health and safety procedures, in addition to the procedures specified in the site specific HASP.

### 12.0 REFERENCES

Mason, B.J. 1983. *Preparation of Soil Sampling Protocol: Technique and Strategies*. EPA-600/4-83-020.

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U.S. Environmental Protection Agency. 1984. *Characterization of Hazardous Waste Sites - A Methods Manual: Volume II*. Available Sampling Methods, Second Edition. EPA-600/4-84-076.

de Vera, ER, B.P. Simmons, R.D. Stephen, and D.L. Storm. 1980. *Samplers and Sampling Procedures for Hazardous Waste Streams*. EPA-600/2-80-018.

American Society for Testing and Materials. *Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils*. Method D 1586-99.

En Novative Technologies, Inc. 2001. *En Core® Sampler Sampling Procedures*. Web site access. March 13, 2001.



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### APPENDIX A

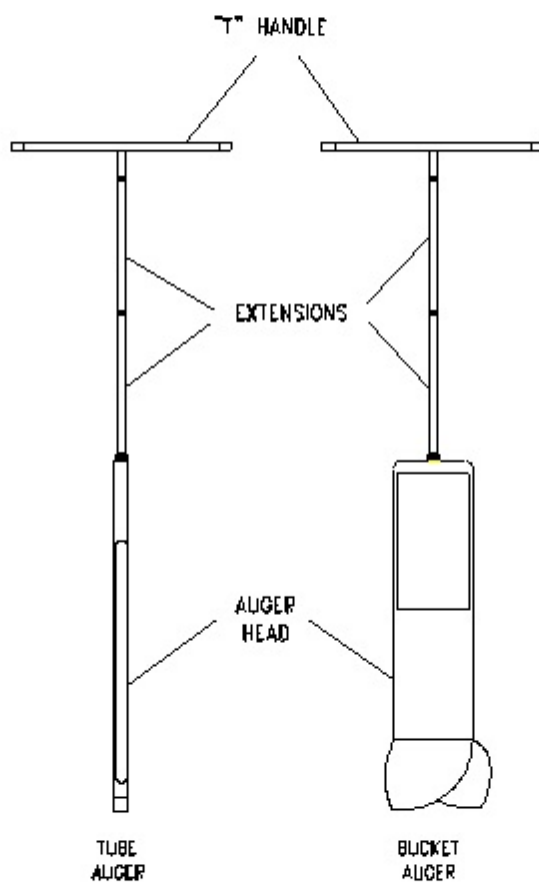
Figures  
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FIGURE 1. Sampling Augers





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